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DEPARTMENT OF THE INTERIOR

UNITED STATES BUREAU OF MINES
JOHN W. FINCH, DIRECTOR

INFORMATION CIRCULAR

BUREAU OF MINES ACTIVITIES IN THE FIELD OF BUILDING MATERIALS

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DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

BUREAU OF MINES ACTIVITIES IN THE FIELD OF BUILDING MATERIALS[1]

Compiled by D. M. Banks[2]

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[1] The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U.S. Bureau of Mines Information Circular 6924."

[2] Building Materials Section, U.S. Bureau of Mines.

BUILDING MATERIALS OF MINERAL ORIGIN

The Bureau of Mines is operated to assist in promoting economic development through increased efficiency in the mining, preparation, treatment, and utilization of mineral substances; to aid in conserving mineral resources through preventing waste; and to help the mining industry improve health conditions and increase safety. Accomplishment of those ends is sought through investigation of scientific, technologic, and economic problems of the mineral industries and dissemination of resulting information.

Building materials of mineral origin constitute an important product of mining, and the Bureau makes studies of these in the various fields mentioned. The following commodities come within this classification: Asbestos, anhydrite, asphalt, cement, clay and clay products, diatomite, dolomite, glass and mineral wool, granite, greenstone, gypsum, lightweight building materials, lime, limestone, magnesite, marble, sand, sand and gravel, sandstone, sand-lime brick, slate, soapstone, and trap rock.

BUILDING MATERIALS SECTION

History. - Virtually since its establishment in 1910 the Bureau's interest has extended to minerals used as building materials. In the beginning the work was handled by the Division of Mineral Technology and then by that unit's successors, the Minerals and Metals Division, Rare Metals and Nonmetals Division, the Metals and Nonmetals Division and the Nonmetal Economics Division. During the World War, War Minerals Investigations conducted surveys of the nonmetallic minerals, and data thus accumulated afforded a nucleus for the extensive research files now maintained by the Building Materials Section.

Profound and significant changes have occurred in the nonmetallic-mineral industries since the World War. The group of nonmetals, of which building materials constitute the major part, virtually equals all metals in terms of value and is second only to mineral fuels in tonnage and in importance to the railroads; before the depression annual production reached a maximum of nearly $1,300,000,000. With the growing importance of these minerals and the constantly increasing demands by the industries for Government assistance in solving their problems it became necessary to establish a new unit to take care of the needs, and in 1928 the Building Materials Section was organized within the Rare Metals and Nonmetals Division.

Economic studies. - A primary function of the Building Materials Section is to conduct studies of trends and developments of the building-material industries with the view of assisting them in solving their economic problems. It is peculiarly equipped to render such service, for it can obtain data not available to individual industries. The studies include investigations of production and consumption of individual mineral commodities, production centers, plants, methods and costs of production and preparation, uses, byproduct uses, transportation problems, markets, prices, substitute materials, and construction programs with relation to the consumption of building materials. Trade trends are analyzed and their economic effects on the industry considered.

Such studies assist operators in regulating production to demand and tend to protect invested capital and labor. An operator who knows of a definite decline in a particular use of his product often can develop new outlets through technical and economic research. In addition, adequate data are vital to the host of new investors who yearly seek to enter the building-materials field. Knowledge of the facts may save utter loss or enable new capital to be invested where it will work to best advantage. Basic information for the studies is acquired by analyses of statistical and other data that have been accumulated in the extensive files of the section through exhaustive research, by attendance at and participation in meetings of trade associations, by conferences and correspondence with leading men in the industries, and by visits to mines, quarries, and manufacturing plants.

Results of such investigations are made available through numerous publications. An explanation of the character of information contained in each series of publications issued may be found in the bibliography that follows.

The section also attempts to assist the industries by putting producers and users of various building materials in touch with each other. To this end numerous lists have been compiled and are supplied to inquirers upon request.

The section cooperated with the Mineral Resources and Economics Division in preparing chapters for Minerals Yearbook, until July 1, 1936, when the work of statistical compilation was transferred to the section. Specialists of the section prepare textual data, which consist of a resumé of conditions in the individual building-materials industries for the preceding year, to accompany the statistics that go to make up the chapters of the volume.

The section also contributes items of interest to a monthly publication issued by the Bureau entitled Mineral Trade Notes. This publication consists of a series of notes and comments on current economic and trade aspects of the various metals and industrial-minerals industries. Embodied therein are reports from American consular officers, transmitted through the courtesy of the Department of State, supplemented by information from other sources.

Service work. - The service work of the section involves answering numerous inquiries propounded by visitors or correspondents. To meet this demand it was necessary to codify available data and develop a suitable background of factual information. This took the form of Information Circulars on individual commodities, which follow a standard topical outline devised to cover the questions most frequently asked. In general, the subject matter is presented as simply as possible so as to be intelligible to the layman. At the same time an effort is made to include data that will have practical value to persons connected with the industry. There are many questions of a more complex nature that cannot be answered so simply; each of them is considered as an individual problem and receives an individual answer.

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SUPPLEMENTARY ACTIVITIES OF THE BUREAU IN BUILDING MATERIALS

Statistical investigations. - Until July 1, 1936, annual statistical surveys were made of building materials of mineral origin in the United States and foreign countries by the Mineral Resources and Economics Division and the Foreign Mineral Service Division of the Bureau, but on that date the statistical work on building materials was transferred to the Building Materials Section of the Nonmetal Economics Division. These surveys include canvasses and investigations of production, consumption, stocks on hand, imports, exports, and prices, and figures thus collected are compiled and appear in the annual publication entitled Minerals Yearbook. These figures are broken down in various ways; for instance, to indicate sales by States or by uses. To accomodate the industries further the Bureau also releases monthly and quarterly reports on certain commodities with the latest available statistical data. International flow charts based on detailed world production and trade statistics are among the economic data made available.

Statistics of men employed, days of operation, man-hours of employment, and accidents and causes thereof at various quarries and mines also are collected. Preliminary figures appear in various Health and Safety Reports issued at intervals, and final figures for the year are published in an annual bulletin entitled Quarry Accidents in the United States. To stimulate interest in safety methods the Bureau conducts a National Safety Competition among operators of quarries and open-pit mines and also among operators of underground nonmetallic-mineral mines and awards a trophy, Sentinels of Safety, for the most outstanding safety performance in each group during the year. Data regarding this competition are published annually as a Report of Investigations.

Investigations of mining and quarrying methods. - Investigations of mining and quarrying methods are conducted by the Mining Division with the view of assisting in developing new and improved methods and equipment and of affording information about the latest improvements as rapidly as they are developed to the end that standards may be raised, resources conserved, and costs kept at a minimum. The work involves first-hand studies of methods of prospecting, mining, preparation, and costs, and dissemination of the information thus gained in published form. A recent series of mimeographed reports on methods and costs, which can be placed in the hands of inquirers quickly, has been prepared by mine operators of the principal mining districts of the country in cooperation with Bureau engineers. More detailed reports appear in printed form.

Scientific and technologic investigations. - The Bureau maintains well-equipped laboratories and a staff of technical experts at its experiment stations throughout the country. Research work on minerals and mineral products used in construction is conducted principally at its Nonmetallic Minerals Experiment Station. Studies are made of chemical and physical properties; methods of preparation, purification, and treatment; uses; and waste utilization. Emphasis is placed on fundamental data. In this work the Bureau renders valuable service to the industries, few of which maintain their own research facilities.

In 1935 the Bureau established testing laboratories for the purpose of making preliminary investigations to determine the feasibility of treating various mineral commodities for the recovery of commercial products.

Health and safety work. - The Health and Safety Branch makes thorough studies of conditions affecting the health and safety of men engaged in mining and quarrying industries. One unit of the branch investigates working conditions and seeks to devise means of preserving health. The other studies causes of accidents and methods of preventing them and teaches first-aid to alleviate the results of accidental injuries.

Identification of mineral specimens. - The Bureau receives a great many requests for the identification or determination of nonmetallic-mineral specimens, and Bureau specialists make many hundreds of such determinations annually.

ACCOMPLISHMENTS

The Building Materials Section has undertaken to accumulate basic data to serve as a background in studies of trends and developments in the building-material industries and has prepared several reports containing such data. One article discusses tonnage and price trends of the leading materials. A circular embodies value data for domestic output of building materials since 1880 and contains brief historical summaries of individual industries. A companion report gives volume data, to furnish more information as to consumptive requirements, and price data in the form of calculated average values. Still another paper presents a general survey of the building-materials field.

The section also attempts to assist producers of building materials of mineral origin in anticipating or forecasting markets for their products. To this end it makes statistical surveys of various phases of the construction field. One such investigation was a compilation of data pertaining to the number, type, and condition of homes in many cities, which was utilized in estimating the potential market for materials used in residential building. This survey revealed that only about 1 percent of the homes use stone as the principal material of construction. Another investigation of housing shortage, involving studies of population increases, building costs, existing vacancies, doubling-up of families, normal construction volume, depreciation, and obsolescence, indicated the value of materials needed to meet the existing deficit.

The more important accomplishments of the Bureau in the field of individual building materials are summarized briefly by commodities. Reports of these accomplishments are listed in the bibliography.

Stone. - Besides annual statistical canvasses of the individual stone industries Bureau engineers have made many special investigations of production and utilization of stone. In response to a demand the Bureau prepared and published a report of the block-granite industry in general and later, at the request of the National Granite Commission, conducted an economic study. A 25-year statistical history of the industry in each leading State was compiled and presented in the form of charts.

Limestone has been a subject of Bureau study for years. Methods of quarrying and treating limestone for the manufacture of lime and of cement have been studied and are described in numerous reports. Problems connected with quarrying, preparing, and utilizing metallurgical stone also have received attention. An increasing movement toward underground mining led to a detailed study of mining methods and costs in 1925; of the 64 limestone mines operating at that time a Bureau representative visited and obtained detailed data from 52. Another study discussed the uses of high-magnesium limestone. Two circulars describe the dimension-limestone and crushed-limestone industries in general.

The marble industry was the first quarrying industry to which the Bureau devoted its attention. As early as 1914 an engineer visited 64 active quarries to study methods and as a result prepared a comprehensive Bureau bulletin on the subject. A similar survey was made of sandstone quarries.

Crushed-stone industries also have received attention. In 1927, in cooperation with the National Crushed Stone Association, the Bureau undertook a study of costs at granite, limestone, sandstone, and trap-rock quarries, for it believed that more intimate knowledge not only of total costs but of the cost of each operation would benefit the industry materially. The next step was a broad study of all economic factors affecting crushed-stone enterprises. Prospecting, costs, methods, power, labor and wages, competitive conditions, marketing problems, transportation facilities, prices, capital investment, tests, and specifications were investigated.

Sand and gravel. - The enormous growth of the sand and gravel industries from 1922 to 1927 created new economic problems. Many new sand and gravel enterprises were started where economic conditions did not warrant their operation. It therefore seemed desirable for a fact-finding organization like the Bureau to present to prospective operators all factors that should be considered before development is begun. The result of this was an Economic Paper entitled "Economics of New Sand and Gravel Developments." This was followed by a series of papers dealing with all problems, methods, and equipment connected with the development of sand and gravel deposits. Another series of papers describing individual operations and costs was prepared by operators in cooperation with Bureau engineers and issued by the Bureau.

Slate. - Before 1922 the slate industry consisted of many small units that employed crude methods of manufacture and had no unified system of marketing. In that year the Bureau assisted in organizing the National Slate Association and in guiding the industry in its movement toward unified effort. It has cooperated closely with this association in conducting economic and technologic studies that have effected great progress in the industry. A Bureau representative made a detailed study of every active slate quarry in the United States and wrote a comprehensive report, which is regarded by the industry as the textbook of quarry and mill practice.

The enormous waste of material in quarrying was a subject of long and careful study by the Bureau, and in 1926 it urged upon the industry the desirability of seeking less wasteful means of cutting slate in the quarry.

Accordingly, cooperating with the National Slate Association, it obtained a wire saw and directed experimental work. These experiments were so successful that within 2 years nearly all the quarries of Pennsylvania were equipped with wire saws. Not only is this equipment reducing the proportion of waste about 50 percent, but it is saving Pennsylvania operators approximately a quarter of a million dollars annually in operation costs.

Intimate study of the industry revealed the fact that slate was losing prestige in the competitive field because frequently it was not diverted to the proper use. This was due to lack of knowledge not only of requirements but also of the physical character of the material itself. In an attempt to remedy this condition the Bureau assisted in organizing Committee D-16 on Slate of the American Society for Testing Materials and has cooperated closely with this committee in directing research and in framing specifications for the various uses of slate.

Lime. - For many years Bureau engineers have been concerned with both economic and technologic problems of lime manufacture. In 1927 the Nonmetallic Minerals Station determined through experimental work the function of steam in the limekiln. At about the same time an engineer devoted his attention to methods of developing and operating lime-plant quarries, which included a study of underground methods. Another studied the advantages and disadvantages of various kilns for calcining small stone and as a result of exhaustive experimental work designed a modified sintering machine suitable for calcining limestone. More recent work was an analysis of trends in sales of lime for many years as shown by Bureau statistics, particularly of the causes for fluctuations in quantities sold for the various uses. A recent report on the lime industry in general has appeared.

Cement. - The Nonmetallic Minerals Experiment Station conducted extensive research to determine the effect of anhydrite as a cement retarder, and this study uncovered important fundamental principles affecting retardation. Methods and equipment used in quarrying stone for cement manufacture have been investigated and described in a Bureau bulletin. A recent series of papers describing methods and costs at individual cement-plant quarries was prepared by operators in cooperation with Bureau engineers.

Gypsum. - In response to a demand for current information a study of the economic phases of the gypsum industry was undertaken in the latter part of 1928. Four Information Circulars contain the results of this study. The first shows the chronological growth of the industry by States; the second analyzes the basic factors in marketing gypsum products; the third is concerned with technology and research in the manufacture of gypsum products; and the fourth is about the Canadian gypsum industry. To comply with numerous requests the Bureau now issues a quarterly statistical report.

Asbestos. - Although the United States produces less than 4 percent of its requirements of asbestos, it is the largest manufacturer of asbestos products in the world. Much interest therefore is manifest in the occurrence, preparation, and utilization of this material. A Bureau specialist, who through personal contacts is familiar with the Canadian and domestic industries and who has made a study of foreign methods as well, has published a series of circulars on the subject. These will be revised and enlarged as a Bureau bulletin.

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Explanation. - The following series of Bureau publications are listed in the bibliography: Bulletins, Technical Papers, Economic Papers, Reports of Investigations, Information Circulars, Mineral Market Reports, Health and Safety Reports, Mineral Resources of the United States and its successor Minerals Yearbook, and individual chapters thereof. Bulletins and Technical Papers present results of scientific and technical investigations. Economic Papers are analytical studies of production, sources, resources, distribution, and industrial flow of mineral commodities. The Minerals Yearbook comprises a series of chapters, each of which presents detailed statistics of and reviews conditions within an individual mineral industry for the year. These chapters are published separately also. Reports of Investigations are short papers that present the principal features and results of minor investigations or of special phases of major investigations. Their function is to make available quickly to the industries and the public the outstanding results of original investigative work. Information Circulars also are short papers, essentially of an informational character. They include compilations, reviews, abstracts, and discussions and as a rule do not represent original investigative work. Their chief purpose is to present the principal facts on subjects of interest in a concise form suitable for sending in reply to inquiries.

Bulletins, Technical Papers, Economic Papers, Mineral Resources, Minerals Yearbook, and individual chapters thereof are printed publications, procurable from the Government Printing Office at the prices listed. The other reports mentioned are mimeographed and are furnished free of charge by the Publications Section of the Bureau upon request. Publications now out of print are marked with an asterisk. All reports published by the Bureau are made available to the public also through a system whereby they are distributed to Government depository libraries as soon as issued. Such libraries are to be found in certain cities and educational institutions of each State.

"Cooperative publications" present results of investigations conducted cooperatively by the Bureau and various agencies. These reports and papers have been written either wholly or partly by members of the Bureau and published by the cooperating agency.

"Technical-press publications" are articles written by Bureau authors that have appeared in technical books and journals, some of which are the official organs of societies. The bibliography includes all such articles on building materials by members of the Building Materials Section that have been published to the present time and in addition those by other Bureau authors that were published before 1934.

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Aggregates

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PIT AND QUARRY. Aggregate Statistics. Vol. 25, May 1933, pp. 17-18; June 1933, pp. 35-38; vol. 26, July 1933, pp. 53-54; August 1933, pp. 40-41, 48; September 1933, pp. 44-45; October 1933, pp. 44-45; November 1933, pp. 41-42; December 1933, pp. 41-43; January 1934, pp. 79-80; February 1934, pp. 49-51; March 1934, pp. 49-51; April 1934, pp. 43-44, 50; May 1934, pp. 43-44, 50; June 1934, p. 43; vol. 27, July 1934, pp. 47-48; August 1934, p. 43; October 1934, p. 45; November 1934, p. 41; December 1934, p. 39; February 1935, pp. 59-60; April 1935, p. 55; vol. 28, August 1935, pp. 43-44; September 1935, pp. 39-40; October 1935, pp. 42-43; November 1935, p. 40.

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ROLLER, P. S. Separation and Size Distribution of Microscopic Particles - An Air Analyzer for Fine Powders. Tech. Paper 490, 1931, 46 pp. 15 cents. The investigation was undertaken in connection with problems concerning dependence of the physical and chemical reactivity of certain substances, notably anhydrite, on particle size. Describes in detail particle-size analysis of a microscopic powder.

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Asbestos

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* BOWLES, OLIVER. Asbestos in South Africa. Rept. of Investigations 2179, 1920, 2 pp. Gives location of deposits and describes quarrying methods.

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FIELDNER, A. C. and EMERY, A. H. Research Activities in the Mineral Industries of the United States. Inf. Circ. 6637, 1932, pp. 126-130. A catalogue of research activities conducted by various agencies in the United States. Problems on asbestos are listed under the section Porous Ceramic Products, Heat Insulation, and Asbestos.

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Building Materials - General

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_____. Nonmetallic Mineral Industries. Min. and Met., vol. 15, January 1934, pp. 52-55.

_____. Nonmetallic Mineral Industries Show Progress in Varied Fields. Min. and Met., vol. 16, January 1935, pp. 3-5.

_____. Building Materials Used in American Homes. Rock Products, vol. 38, September 1935, p. 36.

_____. (reported by). Growing Use of Flotation for Nonmetallic Minerals. Min. and Met., vol. 16, March 1935, pp. 129-130.

_____. Industrial Minerals Record Progress over a Wide Front. Min. and Met., vol. 17, January 1936, pp. 28-33.

BOWLES, OLIVER, and GNAM, CARL A. Obsolescence of American Homes. Rock Products, vol. 38, December 1935, pp. 32-33.

_____. What the Building Shortage Means to the Mineral Industries. Min. and Met., vol. 17, March 1936, pp. 137-138.

BOWLES, OLIVER, and TYLER, P. M. Nonmetallics Acquire Greater Stability. Chem. and Met. Eng., vol. 37, January 1930, pp. 40-42.

LADOO, R. B. Nonmetallic Mineral Industries of United States. Eng. and Min. Jour., vol. 111, Jan. 29, 1921, pp. 215-221.

_____. Future of Nonmetallic Minerals. Eng. and Min. Jour., vol. 113, Jan. 21, 1922, pp. 146-147.

THOENEN, J. R. Activities of the Bureau of Mines in Major Nonmetallic Industries. Rock Products, vol. 31, Dec. 22, 1928, pp. 154-155.

_____. Progress in Studies of Mining Methods in the Nonmetallic Industries by the Bureau of Mines. Rock Products, vol. 34, Jan. 17, 1931, pp. 44-45.

_____. Relation of the United States Bureau of Mines to the Nonmetallic Industries. Rock Products, vol. 35, Feb. 13, 1932, pp. 38-43.

TYLER, P. M. Wage Costs in the Mineral Industries. Min. and Met., vol. 14, November 1933, pp. 447-451; Min. Cong. Jour., vol. 19, December 1933, p. 19.

_____. Where Does the Mine Dollar Go? Min. and Met., vol. 15, April 1934, pp. 183-185.

_____. What Do the Figures Show as to Consumption of the Nonmetallic Minerals? Eng. and Min. Jour., vol. 135, August 1934, pp. 347-349.

_____. Mechanical Preparation of Nonmetallic Minerals. Trans. Am. Inst. Min. and Met. Eng., Milling Methods, vol. 112, 1935, pp. 785-823.

_____. Beneficiation of Nonmetallics. Min. and Met., vol. 16, July 1935, pp. 295-298.

TYLER, P. M., and BOWLES, OLIVER. Economic Notes on the Nonmetallic Mineral Industries. Am. Inst. Min. and Met. Eng. Contribution 50-H, 1933, 20 pp.; Am. Inst. Min. and Met. Eng. Trans., vol. 109, Met. Min. and Nonmet. Minerals, 1934, pp. 318-338.

Cement

Bureau publications:

*. BAYLOR, H. D. Method and Cost of Quarrying Limestone at the Speed Quarry of the Louisville Cement Co., Speed, Ind. Inf. Circ. 6356, 1930, 12 pp. The first of a series of papers describing mining and treatment methods and giving operating costs at cement-plant quarries in the United States. The paper also reviews briefly the history of the cement plant and discusses the administrative and safety organizations. Operations and machinery are illustrated by graphs.

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*Out of print.

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BAYLOR. Method and Cost of Quarrying Limestone at the Milltown Quarry of the Louisville Cement Co., Milltown, Ind. Inf. Circ. 6603, 1932, 9 pp. One of a series of papers designed to disseminate technical information on methods employed in nonmetallic plants throughout the United States. Describes methods of prospecting, quarrying, and crushing; presents an organization chart; and gives a summary of costs.

BERGER, E. E. Calcium Sulphate Retarders for Portland Cement. Rept. of Investigation 2705, 1925, 20 pp. Presents, largely in the form of curves, results of studies of the effect of various retarders on cement. Includes a bibliography.

_____. Calcium Sulphate Retarders for Portland Cement Clinker. Tech. Paper 451, 1929, 35 pp. 10 cents. Describes tests made to determine whether the type of anhydrite and its degree of fineness are factors in the action of anhydrite as a retarder for portland cement. Gives an interpretation and summary of results.

* BOWLES, OLIVER. Rock Quarrying for Cement Manufacture. Bull. 160, 1918, 160 pp. Describes the principal types of cement, growth of the cement industry, and character of raw materials used. Explains quarrying methods and equipment, with special attention to drilling and blasting.

* BOWLES, OLIVER, and CRAWSHAW, J. E. A Fatal Blasting Accident. Rept. of Investigations 2126, 1920, 3 pp. Gives account of a blasting accident in a cement-rock quarry and the conclusions to be drawn.

BOWLES, OLIVER, and JUSTICE, C. W. Growth and Development of the Nonmetallic Mineral Industries. Inf. Circ. 6687, 1933, 50 pp. A condensed 52-year history of the principal nonmetallic-mineral industries, with charts showing the relation of nonmetallic minerals to the building trades, highway construction, population, and industrial production. Contains a table showing the annual production value of cement for the period covered. The accompanying text covers the history of the development of the cement industry in America, with references to chief producing areas.

COX, A. W. Method and Cost of Quarrying, Crushing, and Grinding Limestone at the Security Quarry of the North American Cement Corporation, Security, Md. Inf. Circ. 6554, 1932, 14 pp. In addition to describing methods of quarrying, crushing, and grinding at the plant, the report tells of the administrative and safety organizations and gives costs. The plan of the quarry and crushing plant and a flow sheet showing machinery, output, and material sizes are presented by figures.

DIBBLE, O. A. Clay-Mining Methods and Costs at the Carunna (Mich.) Pit of the Aetna Portland Cement Co. Inf. Circ. 6657, 1932, 6 pp. Reviews the history of the cement company and describes open-pit methods of recovering clay for the manufacture of cement. Cost tabulations represent operating expenditures only and not total costs.

DIENER, F. P., CLEMMER, J. B., and COOKE, S. R. B. Beneficiating Cement Raw Materials by Agglomeration and Tabling. Rept. of Investigation 3247, 1935, 6 pp. Presents results of an investigation of processes of separating flint from cherty limestone by agglomeration and tabling, thus permitting use of material hitherto wasted.

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*Out of print.

FIELDNER, A. C., and EMERY, A. H. Research Activities in the Mineral Industries of the United States. Inf. Circ. 6637, 1932, pp. 130-151. A catalogue of research activities conducted by various agencies in the United States. Problems on cement (including aggregates) are listed under the section Cement and Concrete (Including Aggregates).

FULLERTON, W. J., and COX, A. W. Method and Cost of Quarrying, Crushing, and Grinding Limestone at Catskill Plant of North American Cement Corporation, Catskill, N. Y. Inf. Circ. 6522, 1931, 15 pp. Another of a series of papers describing methods and equipment and giving costs at various cement-plant quarries in the United States.

*_____. Crushing and Grinding Limestone at the Howes Cave (N.Y.) Plant of the North American Cement Corporation. Inf. Circ. 6553, 1932, 7 pp. Discusses methods used in crushing and grinding materials to the degree of fineness required for the cement raw mix.

GANSER, J. W. Method and Cost of Quarrying Limestone and Shale at the Quarry of the Trinity Portland Cement Co., Dallas, Tex. Inf. Circ. 6493, 1931, 12 pp. One of a series of papers describing mining and milling methods and costs at cement-plant quarries throughout the United States. Cost tabulations represent local operating expenditures and not production costs.

_____. Method and Cost of Quarrying Limestone at Quarry of Trinity Portland Cement Co., Fort Worth, Tex. Inf. Circ. 6513, 1931, 13 pp. One of a series of papers describing milling methods and showing operating costs at cement-plant quarries throughout the United States. The paper includes sections on the history of the company, geology of the deposit, and administrative and safety organizations. Operations are illustrated by graphs.

HEALTH AND SAFETY REPORTS. Published annually in mimeographed form as soon after the close of the year as data are available. Contain advance statistics of men employed, days of operation, man-hours of employment, and accidents at cement-rock quarries for the calendar year.

* JOSEPH, T. L. The Production of High-Alumina Slags in the Blast Furnace for the Manufacture of Alumina Cement. Rept. of Investigation 2869, 1928, 7 pp. Discusses value and composition of alumina cements and describes tests in a 6-ton blast furnace.

* McANALLY, S. G. Mining, Crushing, and Grinding Methods and Costs at the Reliance Cement-Rock Quarry of the Giant Portland Cement Co. Inf. Circ. 6448, 1931, 16 pp. One of a series of papers dealing with methods and costs at cement-plant quarries throughout the United States. Describes practices used more or less throughout the Lehigh Valley cement district.

MANN, R. T. Methods and Costs of Quarrying, Crushing, and Grinding Limestone at Plant of Southwestern Portland Cement Co., El Paso, Tex. Inf. Circ. 6608, 1933, 14 pp. Gives details of treatment, equipment, and costs. Illustrations include a map of the quarry and part of the cement plant; a sampling map; a flow sheet of the crushing, drying, and raw-grinding departments; and a diagram of methods of sampling and blending before drying.

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*Out of print.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the portland-cement industry, published annually as soon after the close of the year as figures are available. Contain final figures for the year.

_____. Advance statistical summaries of conditions in the special-cement industry for the year, published annually as soon after the close of the year as figures are available. Contain final figures for the year.

_____. Advance statistical summaries of conditions in the masonry-, natural-, and puzzolan-cement industries for the year, published annually as soon after the close of the year as figures are available. Contain final figures for the year.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Cement. Published each year from 1924 to 1931 as a separate and later as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Present detailed statistics and a résumé of conditions in the cement industry for the year.

MINERALS YEARBOOK. Cement. Published each year from 1932-33 to 1935 as a chapter of the volume. The 1932-33 chapter presents final statistics and a résumé of conditions in the cement industry for the preceding year and appeared also as a separate. The 1934 and 1935 chapters contain preliminary statistics and a résumé for the preceding years. Separates, 5 cents; volumes, $1.25, $1.75, and $2, respectively. Before 1932-33 Minerals Yearbook was published as Mineral Resources of the United States.

MINERALS YEARBOOK STATISTICAL APPENDIX. Cement. Published as chapters of the 1934 and 1935 volumes and also as separates. Separates, 5 cents; volumes, $1. Contain final statistics of the cement industry for the preceding years.

MONTHLY CEMENT STATEMENTS. Current monthly statistics of production, shipments, stocks, foreign trade, and percentage of plant capacity utilized for the country as a whole and for individual producing districts. Supplement includes comprehensive current figures on distribution of cement by States and on final consumption.

MORRISON, G. A. Mining and Crushing Methods and Costs at the West Penn Cement Co. Limestone Mine, West Winfield, Pa. Inf. Circ. 6446, 1931, 21 pp. One of a series of papers on mining methods and operating costs in recovering nonmetallic minerals. Reviews the history of operations at the plant. The double-entry system with rooms to right and left is now employed. Operations are illustrated by graphs.

* MYERS, W. M. Storage and Transportation of Portland Cement. Rept. of Investigations 2377, 1922, 5 pp. Gives results of investigation to determine causes of deterioration of cement in transit and storage. Includes bibliography.

* PARSONS, C. L. Notes on Mineral Wastes. Bull. 47, 1912, 44 pp. The introduction discusses variety of wastes, need of preventing mineral waste, and losses through inefficient methods of treatment and use. One section is devoted to losses in the utilization of materials for cement.

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*Out of print.

QUARRY ACCIDENTS IN THE UNITED STATES. Published annually in bulletin form. Include statistics of men employed, days of operation, man-hours of employment, and accidents at cement-rock quarries and mills in each producing State for the calendar year.

ROBOTHAM, C. A. Mining Limestone by a Caving Method at Crestmore Mine of the Riverside Cement Co., Crestmore, Calif. Inf. Circ. 6795, 1934, 20 pp. Describes unusual method of underground mining practice, based upon technique employed in the copper mines of the Ray and Globe-Miami districts of Arizona. Figures show plan of development, shaft and tipple system, undercut caving method, section through undercut caving method, and various other details of the plant.

SMITH, EMORY. Effect of a Bonus on the Accident Record of the Southwestern Portland Cement Co. Inf. Circ. 6176, 1929, 5 pp. Presents the excellent record of a mine where the bonus system and the all-employee safety-committee system are in effect.

TOWNSEND, R. H. Method and Cost of Quarrying Limestone at Plant of Calaveras Cement Co., San Andreas, Calif. Inf. Circ. 6610, 1933, 11 pp. Discusses mining, transportation, and crushing methods, describes equipment used, and shows operating expenditures.

TYLER, P. M. Consumption and Prices of Nonmetallic Minerals. Inf. Circ. 6794, 1934, 50 pp. Summarizes consumption data for pre-war and postwar periods; discusses trend toward national self-sufficiency, prices, and the effects of the depression; and gives tables for the principal nonmetallic commodities, listing domestic production, net imports or exports, apparent consumption, and indexes of consumption and unit value from 1910 to 1935. A table for cement is included.

*WEST, G. H., SEBASTIAN, R. L., and DARROW, W. A. Bibliography of Magnesian Cements. Rept. of Investigation 2534, 1923, 15 pp. Lists 211 publications.

Technical-press publications:

BERGER, E. E. Retarders for Portland Cement. Pit and Quarry, vol. 11, Nov. 1, 1925, pp. 81-88; Nov. 15, 1925, pp. 55-64.

_____. The Effect of Retarders on Portland Cement Clinker. Rock Products, vol. 31, Dec. 8, 1928, pp. 50-51; Cement, Lime, and Gravel, vol. 3, January 1929, pp. 91-93.

BERK, A. A., and ROLLER, P. S. Direct Determination of Alkalies in Portland Cement. Concrete, Cement Mill sec., vol. 43, March 1935, pp. 38-39.

BOWLES, OLIVER, and HUGHES, H. H. The Story of Cement. Canadian Min. and Met. Bull., no. 259, November 1933, pp. 525-536.

HUGHES, H. H. A Study of Hours of Work and the Rates of Pay of Cement Workers. Pit and Quarry, vol. 26, September 1933, pp. 20-22.

_____. Correlation of Productivity and Hours of Labor in the Cement Industry. Pit and Quarry, vol. 26, October 1933, pp. 35-36, 39-40.

_____. Capacity of the Cement Industry. Rock Products, vol. 37, March 1934, pp. 33-35.

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*Out of print

HUGHES, H. H., SHUEY, E. T., and ADAMS, W. W. Trends in Employment and Productivity of Labor in the Cement Industry. Pit and Quarry, vol. 28, August 1935, pp. 24-26, 30.

ROLLER, P. S. The Setting of Portland Cement: Chemical Reactions and the Role of Calcium Sulfate. Ind. and Eng. Chem., vol. 26, June 1934, pp. 669-677.

_____. The Setting of Portland Cement: Chemical Reactions of Seasoning, Reversion, and Restoration. Ind. and Eng. Chem., vol. 26, October 1934, pp. 1077-1083.

Clay

Bureau publications:

BOWLES, OLIVER, AND JUSTICE, C. W. Growth and Development of Nonmetallic-Mineral Industries. Inf. Circ. 6687, 1933, 50 pp. Contains a table showing annual production value of clay products since 1880. Accompanying text covers the history of the usage of clay, present industrial uses, sources of raw material, and location of the leading clay-products manufacturers.

DIBBLE, O. A. Clay-Mining Methods and Costs at the Carunna (Mich.) Pit of the Aetna Portland Cement Co. Inf. Circ. 6657, 1932, 6 pp. Reviews the history of the cement company and describes open-pit methods of recovering clay for the manufacture of cement. Cost tabulations represent operating expenditures and not total costs.

FIELDNER, A. C., and EMERY, A. H. Research Activities in the Mineral Industries of the United States. Inf. Circ. 6637, 1932, pp. 115-125. A catalogue of research activities conducted by various agencies in the United States. Problems on clay are listed under the section Heavy Clay Products and Refractories.

GANSER, J. W. Method and Cost of Quarrying Limestone and Shale at the Quarry of the Trinity Portland Cement Co., Dallas, Tex. Inf. Circ. 6498, 1931, 12 pp. One of a series of papers describing mining and milling methods and costs at cement-plant quarries throughout the United States. Cost tabulations represent local operating expenditures and not total production costs.

LINTNER, E. J. Mining and Grinding Methods and Costs at the Claycraft Co. Shale Pit, Taylor Station, Columbus, Ohio. One of a series of papers on methods and costs at nonmetallic-mineral operations. Describes procedure at efficiently managed shale pit in the Middle West.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the clay industry, published annually as soon after the close of the year as data are available. These reports furnish final figures for the year.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Clay. Published each year from 1924 to 1931 as a separate and later as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Include detailed statistics and a resumé of conditions in the clay industry for the preceding year.

MINERALS YEARBOOK. Clay. Published from 1932-33 to 1935 as a chapter of the volume. The 1932-33 chapter contains preliminary statistics and a résumé of conditions in the clay industry for the preceding year. The 1934 and 1935 chapters contain final statistics and résumés for the preceding years and appeared also as separates. Separates, 5 cents each; volumes, $1.25, $1.75, and $2 respectively. Before 1932-33 Minerals Yearbook was published as Mineral Resources of the United States.

MINERALS YEARBOOK STATISTICAL APPENDIX. Clay. Published as a chapter of the 1932-33 volume and also as a separate. Separates, 5 cents; volume, $1. Contains final statistics of the clay industry for the preceding year.

SCHURECHT, H. G. Use of Electrolytes in the Purification and Preparation of Clays. Tech. Paper 281, 1922, 47 pp. The paper presents a study of the relation between the percentage of alkali necessary to maintain minimum viscosity in clay slips, the effects of alkalies and acids on the strength of clay, and the increase in plasticity and strength of nonplastic clays by special treatment, such as wet grinding, addition of electrolytes, removal of coarse material by screening, and addition of an organic binder.

STULL, R. T., and BOLE, G. A. Beneficiation and Utilization of Georgia Clays. Bull. 252, 1926, 72 pp. Describes the occurrence and geology of Georgia clays; gives results of washing and physical tests; and discusses their utilization in various products. Results indicated that light-gray and face brick can be made from Georgia kaolin, aplite, and sand and that the so-called "hard" kaolins are the most desirable for brickmaking.

TYLER, P. M. Clay. Inf. Circ. 6155, 1929 (rev. 1935), 66 pp. A résumé of elementary factors affecting the potential commercial value of a clay deposit. Discusses nature of deposits, varieties and classification of clays, preliminary examinations and laboratory tests to determine usefulness, mining and preparation processes, uses and products, manufacturing processes, production, imports, exports, markets, and prices. Includes a bibliography.

_____. Consumption and Prices of Nonmetallic Minerals. Inf. Circ. 6794, 1934, 50 pp. Summarizes consumption data for pre-war and post-war periods; discusses trend toward national self-sufficiency, prices, and the effects of the depression; and gives tables for the principal nonmetallic commodities, listing domestic production, imports, apparent consumption, and indexes of consumption and unit value from 1910 to 1935. A table for the clay products common brick, face brick, and hollow building tile is included.

WILSON, HEWITT, PAGE, G. A., and CARTWRIGHT, V. S. Dewatering Clay Suspensions by Spray Evaporation. Rept. of Investigation 3248, 1935, 42 pp. A report of progress of an investigation conducted at the Northwest Experiment Station on processes of dewatering plastic kaolins. This study includes a review of commercial practice with spray evaporators for miscellaneous products; some theoretical considerations of the capacity of disk rotors; the velocity of clay particles falling in air and the heat and air necessary for evaporation; and some experimental work with laboratory evaporators, air atomizers, high-pressure liquid atomizers, and centrifugal sprayers.

Cooperative publications:

*. BECKSTRAND, E. H. Results of Experiments on Sewer Pipe and Drain Tile. University of Utah Bull. 7, 1915.

† STULL, R. T., and HURSH, R. K. Tests on Clay Materials Available in Illinois Coal Mines. University of Illinois and the Illinois Geological Survey Bull. 18, 1917, 130 pp. 50 cents. Discusses characteristics of clays for common brick, front brick, hollow ware, and fireproofing, and the behavior of clays during burning. Gives results of tests and includes numerous graphs illustrating tests.

* STULL, R. T., and OTHERS. The Burning Problem of Industrial Kilns, with a Chapter on Laboratory Control. 1924, 182 pp. (With the four heavy-clay products associations.) Results of field work of an investigation of industrial kilns, the objects of which were to obtain burning data on various types of kilns using different fuels and different clays and to demonstrate how both time and fuel can be saved and the quality of the products improved. The operation of two common-brick, two face-brick, two paving-brick, and two hollow-building-tile kilns, a continuous chamber kiln, and a tunnel kiln were studied and a report made on each.

* WILSON, HEWITT. The Clays and Shales of Washington - Their Technology and Uses. Univ. of Washington Bull. 18, 1923, 224 pp. Gives the geology of clays from the seven natural topographic provinces of Washington. The objects of testing clays as given are: To classify clays according to their commercial types, to determine the difficulties that will be experienced in the manufacturing process and devise ways and means of overcoming them, and to discover the method of producing the maximum quantity of ware at minimum cost. Each type of clay in the State is described, and testing data are given.

Technical-press publications:

CURTIS, C. E. The Electrical Dewatering of Clay Suspensions - Part I. Jour. Am. Ceram. Soc., vol. 14, March 1931, pp. 219-263.

HARRISON, H. C. Roof Brick for the Open Hearth. Jour. Am. Ceram. Soc., Vol. 7, September 1924, pp. 698-705.

STULL, R. T. Need of Technical Assistance in the Brick Industry. Jour. Am. Ceram. Soc., vol. 3, March 1920, pp. 180-184.

_____. Government Service in Developing the Clay Industry. Clay Worker, vol. 73, Mar. 25, 1920, pp. 356-358.

STULL, R. T., and BOLE, G. A. Utilization of Georgia Kaolins in the Manufacture of Face Brick. Jour. Am. Ceram. Soc., vol. 7, May 1924, pp. 347-358.

TILLEY, G. S., and SULLIVAN, J. D. Rational Analysis of Clays. Jour. Am. Ceram. Soc., vol. 7, May 1924, pp. 379-381.

WEIGEL, W.M. High-Grade Clays of the Southeastern States. Min. Cong. Jour., vol. 12, March 1926, pp. 157-161.

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*Out of print.

†Obtainable from Illinois Geological Survey, Urbana, Ill.

Diatomite

Bureau publications:

BOWLES, OLIVER, and JUSTICE, C. W. Growth and Development of the Nonmetallic-Mineral Industries. Inf. Circ. 6637, 1933, 50 pp. A condensed 52-year history of the principal nonmetallic-mineral industries. Contains a table showing production value of diatomite and tripoli for the period covered. The accompanying text explains why the two materials were grouped together and the development of new uses for diatomite.

* DAVIS, C. W. Diatomaceous Earth. Rept. of Investigations 2718, 1925, 14 pp. Describes properties, uses, occurrence, and production of Nevada diatomite. Includes a bibliography.

* GARDNER, E. D. Mining Diatomaceous Earth at Lompoc, Calif. Rept. of Investigations 2431, 1923, 2 pp. Describes deposit and mining methods.

HATMAKER, PAUL. Diatomite. Inf. Circ. 6391, 20 pp. A brief review of the diatomite industry. Describes diatomite, its occurrence, distribution, properties, and uses. Discusses methods of preparation and marketing, prices, and economic conditions of the industry. Includes lists of producers and buyers and a bibliography.

* PARSONS, C. L. Notes on Mineral Wastes. Bull. 47, 1912, 44 pp. The introduction discusses the need of preventing mineral waste, variety of wastes, and losses through inefficient methods of treatment and use. One paragraph is devoted to the uses and potential uses of infusorial earth or diatomite.

Technical-press publications:

PHALEN, W. C. Diatomaceous Earth in Industry. Chem. Eng., vol. 28, April 1920, pp. 113-115.

_____. Diatomaceous or Infusorial Earth. Chem. and Met. Eng., vol. 22, May 26, 1920, pp. 981-982.

Dolomite

Bureau publications:

HATMAKER, PAUL. Utilization of Dolomite and High-Magnesium Limestone. Inf. Circ. 6524, 1931, 18 pp. Describes the composition and properties of dolomite and covers briefly the particular field of dolomite and magnesium limestone. Discusses occurrence, production prices, imports, and duties. Includes a bibliography.

Technical-press publications:

LEAVER, E. S., DAVIS, C. W., and WOOLF, J. A. Calcined Dolomite as a Substitute for Lime. Arizona Min. Jour., vol. 8, Feb. 15, 1925, pp. 7-8.

STULL, R. T. Experimental Separation of Lime in Dolomite. Jour. Franklin Inst., vol. 190, p. 739.

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*Out of print.

Granite

Bureau publications:

*BOWLES, OLIVER. Blasting Granite with Compressed Air. Rept. of Investigation 2154, 1920, 3 pp. Describes use of compressed air in a Georgia granite quarry.

_____. The Granite Industry - Dimension Stone. Inf. Circ. 6268, 1930, 10 pp. A brief description of the block-granite industry. Discusses the character and occurrence of granite, distribution of deposits in the United States, and the requisites of a deposit for the production of dimension stone and furnishes general information on quarrying and milling methods. The chief uses are for building purposes, memorials, and curbing. Production statistics and data on foreign trade are given.

BOWLES, OLIVER, and HATMAKER, PAUL. Trends in the Production and Uses of Granite as Dimension Stone. Rept. of Investigations 3065, 1931, 21 pp. Describes general economic conditions in the granite industry from 1906 to 1928 and outlines trends by States. Discusses problems of the industry and suggests means of improvement and expansion.

HEALTH AND SAFETY REPORTS. Published annually in mimeographed form as soon after the close of the year as data are available. Contain advance statistical data of men employed, days of operation, man-hours of employment, and accidents at granite quarries for the calendar year.

KATZ, S. H. Investigations of Dust in the Air of Granite-Working Plants. Rept. of Investigations 2213, 1921, 2 pp. Describes an investigation of industrial disease in a Vermont granite center.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the stone industries, published annually as soon after the close of the year as figures are available. Include final production figures of dimension granite, by uses, for the preceding year.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Stone. Published each year from 1924 to 1931 as a separate and later as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Include detailed statistics and a resumé of conditions in the granite industry for the preceding year.

MINERALS YEARBOOK. Dimension Stone. Published each year from 1932-33 to 1935 as a chapter of the volume. Volumes, $1.25, $1.75, and $2, respectively. Present preliminary statistics and a résumé of conditions in the granite industry for the preceding year.

MINERALS YEARBOOK STATISTICAL APPENDIX. Stone. Published each year from 1932-33 to 1935 as a chapter of the volume and also as a separate. Separates, 5 cents; volumes, $1. Contain final statistics of the granite industry for the preceding year.

QUARRY ACCIDENTS IN THE UNITED STATES. Published annually in bulletin form. Include statistics of men employed, days of operation, man-hours of employment, and accidents at granite quarries in each producing State for the calendar year.

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*Out of print.

THOENEN, J. R. Study of Quarry Costs - Trap Rock, Sandstone, Granite. Inf. Circ. 6291, 1930, 24 pp. A second study of quarry costs. Summarizes costs of various operations at granite quarries, based on total tonnages sold in the calendar year 1927, as reported to the Bureau by operators.

* WESTON, T. I. Methods and Costs at the Granite Quarry and Crushed-Stone Plant of the Weston & Brooker Co., Cayce, S.C. Inf. Circ. 6744, 1933, 13 pp. One of a series of papers on mining and treatment methods and operating costs at nonmetallic-mineral plants in the United States.

Technical-press publications:

INSLEY, H., TOSTEL, L. J., and KATZ, S. H. Dustiness of Air in Granite Cutting Plants. Jour. Am. Soc. Heat. and Vent. Eng., vol. 28, 1922, pp. 421-447.

HATMAKER, PAUL. Dollars or Waste Piles. Rock Products, vol. 34, Sept. 12, 1931, pp. 33-37.

Greenstone

Technical-press publications:

HUGHES, H. H. A Green Building Stone. Stone, vol. 55, April 1934, pp. 160-162.

Gypsum

Bureau publications:

BOWLES, OLIVER. Sources of Limestone, Gypsum, and Anhydrite for Dusting Coal Mines to Prevent Explosions. Bull. 247, 1925, 70 pp. 25 cents. Gives information on methods of applying rock dust in mines, cost of dusting coal mines, sources of dusting materials, and analysis of quarry samples.

BOWLES, OLIVER, and JUSTICE, C. W. Growth and Development of the Nonmetallic Mineral Industries. Inf. Circ. 6887, 1933, 50 pp. A condensed 52-year history of the principal nonmetallic-mineral industries, with charts showing the relation of nonmetallic minerals to the building trades, highway construction, population, and industrial production. Contains a table showing the annual production value of gypsum for the period covered. The accompanying text covers developments in manufacture and usage.

BRADLEY, W. G. Methods and Costs of Mining and Crushing Gypsum at the Mine of the Blue Diamond Corporation, Ltd., Arden, Nev. Inf. Circ. 6615, 1932, 10 pp. Includes information on the geology of the formation, explains exploration and mining methods, presents an organization chart of crushing plant, with flow sheet of plant, and contains table summarizing costs.

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*Out of print.

*FARNSWORTH, MARIE. Effects of Temperature and Pressure on Gypsum and Anhydrite. Rept. of Investigations 2654, 1924, 3 pp. A record of studies made to determine methods of accelerating the rehydration of anhydrite. Methods of testing the effect of high temperature and pressure on gypsum and anhydrite are described. While results indicated that anhydrite cannot be rehydrated under such conditions the tests established certain facts bearing on the stability relations of gypsum and anhydrite.

FIELDNER, A. C., and EMERY, A. H. Research Activities in the Mineral Industries of the United States. Inf. Cir. 6637, 1932, pp. 128-130. A catalogue of research activities conducted by various agencies in the United States. Problems on gypsum are listed under the section Lime, Gypsum, and Plaster.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the gypsum industry, published annually as soon after the close of the year as figures are available. Contain final figures for the year.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Gypsum. Published each year from 1924 to 1931 as a separate and later as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Present detailed statistics and a résumé of conditions in the gypsum and gypsum-products industries for the preceding year.

MINERALS YEARBOOK. Gypsum. Published from 1932-33 to 1935 as a chapter of the volume. The 1932-33 chapter contains preliminary statistics and a résumé of conditions in the gypsum industry for the preceding year. The 1934 and 1935 chapters contain final statistics and a résumé of conditions in the industry for the preceding years and appeared also as separates. Separates, 5 cents each; volumes, $1.25, $1.75, and $2, respectively. Before 1932-33 Minerals Yearbook was published as Mineral Resources of the United States.

MINERALS YEARBOOK STATISTICAL APPENDIX. Gypsum. Published as a chapter of the 1932-33 volume and later as a separate. Separates, 5 cents; volumes, $1. Contains final statistics of the gypsum industry for the preceding year.

QUARTERLY GYPSUM REPORT. Current quarterly statistics of production, imports, and sales of gypsum and gypsum products, released as soon after the end of the quarter as data are available.

*SANTMYERS, R. M. Gypsum - Its Uses and Preparation. Inf. Circ. 6163, 1929, 28 pp. Gives a brief sketch of the history of the gypsum industry, describes the properties of gypsum, discusses mining and preparation methods and uses, and concludes with a summary of the advantages of gypsum building materials.

*_____. Development of the Gypsum Industry by States. Inf. Circ. 6173, 1929 (2d ed., 1930), 44 pp. Summary of production and sales of gypsum in the United States from the beginning of the industry to the present. Includes lists of manufacturers of gypsum products and importers of crude gypsum and a bibliography.

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*Out of print.

*SANTMYERS, R. M. The Canadian Gypsum Industry. Inf. Circ. 6162, 1929, 27 pp. Describes producing districts and discusses methods and costs of producing, shipping, and handling; prices; labor; and wages. Concludes with a statistical summary of production and consumption.

*_____. Marketing of Gypsum Products. Inf. Circ. 6157, 1929, 26 pp. Presents statistical data regarding sales of crude gypsum, gypsum building materials, and other gypsum products.

*STONE, R. W. Gypsum Products - Their Preparation and Uses. Tech. Paper 155, 1917, 67 pp. Describes methods of quarrying and preparing gypsum, gives costs of producing and marketing gypsum plaster, discusses gypsum products and their uses, and gives sources of gypsum and gypsite.

TYLER, P. M. Consumption and Prices of Nonmetallic Minerals. Inf. Circ. 6794, 1934, 50 pp. Summarizes consumption data for pre-war and post-war periods; discusses trend toward national self-sufficiency, prices, and the effects of the depression; and gives tables for principal nonmetallic-mineral commodities, listing domestic production, imports, apparent consumption, and indexes of consumption and unit value. A table for crude gypsum from 1910 to 1935 is included.

Technical-press publications:

BOWLES, OLIVER, and FARNSWORTH, MARIE. Physical Chemistry of Calcium Sulphates and Gypsum Reserves. Econ. Geol., vol. 20, Dec. 15, 1925, pp. 738-745.

BRADLEY, W. G. Methods and Costs of Crushing and Grinding Gypsum at the Mine of the Blue Diamond Corporation (Ltd.), Arden, Nev. Rock Products, vol. 35, Sept. 10, 1932, pp. 34-38.

Lime

Bureau publications:

BERGER, E. E. The Function of Steam in the Limekiln. Tech. Paper 415, 1927, 43 pp. 10 cents. Reviews previous investigations and explains the Bureau's method of experimentation. Steam was found to be advantageous because the endothermic reaction with the incandescent carbon of the fuel reduces heat intensity at the grate, and secondary oxidation of gases over the fuel beds extends the flame and produces more uniform calcination.

*BOWLES, OLIVER. Use of the Churn Drill at Lime-Plant Quarries. Rept. of Investigations 2424, 1922, 7 pp. Describes various types of drills and shows advantages claimed for the churn drill and conditions disadvantageous for its use.

*_____. Quarrying to Obtain a Uniform Lime Product. Rept. of Investigations 2479, 1923, 6 pp. Suggests methods of quarrying flat-lying and steeply inclined beds to obtain uniform stone and of disposing of inferior material.

*_____. Utilization of Waste Rock at Lime Plants. Rept. of Investigations 2463, 1923, 5 pp. Suggests various uses for waste rock, such as ballast, concrete aggregate, chicken grit, agricultural limestone, and filler.

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*Out of print.

* BOWLES Transportation Systems at Lime-Plant Quarries. Rept. of Investigations 2454, 1923, 6 pp. Discusses trackage, quarry cars, haulage on inclines, and costs.

* _____. Rock Loading at Lime-Plant Quarries. Rept. of Investigations 2446, 1923, 5 pp. Discusses advantages and disadvantages of hand loading and of steam shovels.

* _____. Mining Limestone for Lime Manufacture. Rept. of Investigations 2585, 1924, 9 pp. A brief discussion of topographical and geological conditions influencing the adoption of underground methods in limestone for the manufacture of lime and the advantages and disadvantages of the method. Certain limestone mines are described to illustrate the various types of mines.

BOWLES, OLIVER, and BANKS, D. M. Lime. Inf. Circ. 6884, 1936, 37 pp. Covers varieties of lime; chemical and physical properties; history of the industry; principal raw materials and their distribution in this country; principal uses, with specifications, production; methods of quarrying and manufacture; storage and shipment; markets and prices; and foreign trade. Also includes a bibliography.

BOWLES, OLIVER, and MYERS, W. M. Quarry Problems in the Lime Industry. Bull. 269, 1927, 93 pp. 25 cents. Presents economical and efficient methods of developing and operating a lime-plant quarry. Discusses advantages and disadvantages of mining methods and utilization of waste rock.

BOWLES, OLIVER, and JUSTICE, C. W. Growth and Development of the Nonmetallic Mineral Industries. Inf. Circ. 6687, 1933, 50 pp. A condensed 52-year history of the principal nonmetallic-mineral industries, with charts showing the relation of nonmetallic minerals to the building trades, highway construction, population, and industrial production. Contains a table showing annual production value of lime for the period covered. The accompanying text reviews developments in usage of lime in various products.

FIELDNER, A. C., and EMERY, A. H. Research Activities in the Mineral Industries of the United States. Inf. Circ. 6637, 1932, pp. 128-130. A catalogue of research activities conducted by various agencies in the United States. Problems on lime are listed under the section Lime, Gypsum, and Plaster.

HATMAKER, PAUL. Trade Trends in the Lime Industry. Rept. of Investigations 3227, 1934, 18 pp. An analysis of the history of sales of lime. Reviews sales by consuming industries or uses, and presents tables and charts correlating business data with current markets for this commodity.

HEALTH AND SAFETY REPORTS. Accident-Prevention Record of the Lime Industry. An annual report covering the accident-prevention record of the lime industry for certain years.

HEALTH AND SAFETY REPORT. National Lime Association Safety Contest, 1935. A report of the first National Lime Association Safety Competition, which was conducted by the United States Bureau of Mines. The report explains the plan of the contest and gives the names of the companies making the best safety record.

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*Out of print.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the lime industry for the preceding year. The first issue, published soon after the close of the year, contains preliminary figures, subject to revision, and the second issue, published later, contains final figures for the year.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Lime. Published each year from 1924 to 1931 as a separate and also as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Present detailed statistics and a resumé of conditions in the lime industry for the preceding year.

MINERALS YEARBOOK. Lime. Published each year from 1932-33 to 1935 as a chapter of the volume. Volumes, $1.25, $1.75, and $2, respectively. Present preliminary statistics and a resumé of conditions in the lime industry for the preceding year. Before 1932-33 Minerals Yearbook was published as Mineral Resources of the United States.

MINERALS YEARBOOK STATISTICAL APPENDIX. Lime. Published each year from 1932-33 to 1935 as a chapter of the volume and also as a separate. Separates, 5 cents; volumes, $1. Contain final statistics of the lime industry for the preceding year.

*MYERS, W. M. The Production of Lime from Small Stone. Rept. of Investigations 2596, 1924, 9 pp. Presents advantages and disadvantages of various types of kilns for calcining small stone.

*_____. Manufacture of Lime from Small Stone with a Sintering Machine. Rept. of Investigations 2762, 1926, 16 pp. Discusses the sintering machine as a means of manufacturing lime from small stone and thus recovering a salable product from material that might be wasted.

TREMOUREUX, R. E. Quarrying Methods and Costs at the Sloan Quarry of the United States Lime Products Corporation, Sloan, Nev. Inf. Circ. 6599, 1932, 8 pp. One of a series of papers designed to disseminate information regarding methods and costs used at various plants throughout the United States.

TYLER, P. M. Consumption and Prices of Nonmetallic Minerals. Inf. Circ. 6794, 50 pp. Summarizes consumption data for pre-war and post-war periods; discusses trend toward national self-sufficiency, prices, and the effects of the depression; and gives tables for principal nonmetallic-mineral commodities, listing domestic production, net imports or exports, apparent consumption, and indexes of consumption and unit value. A table for lime from 1910 to 1935 is included.

Technical-press publications:

BOWLES, OLIVER. Untrodden Field in Lime Research. Concrete, vol. 23, July 1923, p. 127; Chem. and Met. Eng., vol. 28, Mar. 7, 1923, p. 447.

_____. Work of the U. S. Bureau of Mines in the Lime Industry. Quarry Managers' Jour., vol. 5, July 1923, p. 441.

_____. Important Problems in the Lime Industry with Special Reference to Ohio. Rock Products, vol. 28, July 25, 1925, pp. 41-44.

_____. Recent Progress and Future Tendencies in the Lime Industry. Ind. and Eng. Chem., vol. 19, May 1927, pp. 554-556.

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*Out of print.

FARNSWORTH, MARIE. X-Ray Study of Limes Having Different Plasticities. Ind. and Eng. Chem., vol. 19, May 1927, pp. 583-588.

HATMAKER, PAUL. Keep Going with the Ordinary Stone and Lime Plant. Rock Products, vol. 36, Oct. 25, 1933, pp. 17-20.

HEAD, R. E. Lime Scale as a Concentrate. Min. and Met., vol. 9, October 1928, pp. 455-457.

STULL, R. T. Experimental Separation of Lime in Dolomite. Jour. Franklin Inst., vol. 190, 1920, p. 739.

Limestone

Bureau publications:

*BAYLOR, H. D. Method and Cost of Quarrying Limestone at the Speed Quarry of the Louisville Cement Co., Speed, Ind. Inf. Circ. 6356, 1930, 12 pp. The first of a series of papers describing mining and treatment methods and giving operating costs at nonmetallic-mineral mines, quarries, and pits in the United States. The paper includes a brief review of the history of the cement plant and a discussion of the administrative and safety organizations. Operations and machinery are illustrated by graphs.

_____. Method and Cost of Quarrying Limestone at the Milltown Quarry of the Louisville Cement Co., Milltown, Ind. Inf. Circ. 6603, 1932, 9 pp. One of a series of papers designed to disseminate technical information on methods employed in nonmetallic-mineral plants throughout the United States. Describes methods of prospecting, quarrying, and crushing; presents an organization chart; and gives a summary of costs.

BOLIN, D. C. Mining and Crushing Methods and Costs at Tiffin Limestone Quarry of Thurber Earthen Products Co., Fort Worth, Tex. Inf. Circ. 6531, 1931, 18 pp. One of a series of papers describing equipment and operation of quarries throughout the United States.

*BOWLES, OLIVER. Labor Saving at Limestone Quarries. Tech. Paper 203, 1919, 26 pp. Points out the necessity of reducing labor costs at quarries and calls attention to various labor-saving methods and devices.

* _____. Stripping Problems in Limestone Quarries of the Shenandoah Valley. Rept. of Investigations 2401, 1922, 6 pp. Cites difficulties experienced in removing overburden and suggests that mechanical removal might reduce stripping expense.

* _____. Utilization of Waste Rock at Lime Plants. Rept. of Investigations 2463, 1923, 5 pp. Suggests various uses for waste rock, such as ballast, concrete aggregate, chicken grit, agricultural limestone, and filler.

* _____. Mining Limestone for Lime Manufacture. Rept. of Investigations 2585, 1924, 9 pp. A brief discussion of topographical and geological conditions influencing the adoption of underground methods in limestone for the manufacture of lime and of the advantages and disadvantages of the method. Certain limestone mines are described to illustrate the various types of mines.

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*Out of print.

BOWLES Sources of Limestone, Gypsum, and Anhydrite for Dusting Coal Mines to Prevent Explosions. Bull. 247, 1925, 70 pp. 25 cents. Gives information on methods of applying rock dust in mines, cost of dusting coal mines, sources of dusting materials, and analyses of quarry samples.

_____. Chalk, Whiting, and Whiting Substitute. Inf. Circ. 6482, 1931, 13 pp. Chalk and whiting are imported products. Whiting substitutes are ground limestone or marble or precipitated calcium carbonate. The report describes deposits in the United States that might be classed as chalk, methods of purifying true chalk, and methods of preparing whiting substitutes. The uses of whiting and whiting substitutes are enumerated, and data on prices, production, and foreign trade are added.

_____. Significant Features of Wire-Saw Operation in Europe. Inf. Circ. 6483, 1931, 3 pp. Reviews the extent to which wire saws are used in Italy, France, and Belgium, compares European and American practice, and gives data on costs and rates of sawing.

_____. Limestone. Part II - Dimension Stone. Inf. Circ. 6756, 1933, 16 pp. This paper, devoted to building limestone, is companion to another covering crushed, broken, and pulverized limestone. The requisite qualities of deposits suitable for the production of building stone and the various forms in which the stone is used are described. Other topics discussed are centers of production, quarrying and milling methods, costs, and marketing. More than 80 percent of the building limestone produced in the United States originates in the Salem formation of the Bedford and Bloomington, Ind., area.

BOWLES, OLIVER, and MYERS, W. M. Quarry Problems in the Lime Industry. Bull. 269, 1927, 93 pp. 25 cents. Presents economical and efficient methods of developing and operating a lime-plant quarry. Discusses advantages and disadvantages of mining methods and the utilization of waste rock.

BOWLES, OLIVER, and BANKS, D. M. Limestone, Part I - General Information. Inf. Circ. 6723, 1933, 21 pp. Describes the various varieties of limestone, explains the economic importance of each branch of the industry - dimension stone and crushed stone - and tabulates production by States and uses. Proceeds with a discussion of the different phases of the crushed-stone industry, including quarry and preparation methods, operating costs, uses, markets, and prices.

_____. Onyx Marble and Travertine. Inf. Circ. 6751, 1933, 11 pp. Defines the terms "onyx" and "travertine" and discusses the origin, occurrence, and uses of each. Domestic and foreign deposits of commercial importance are described. The most important deposit of onyx is in Mexico and of travertine in Italy.

COX, A. W. Method and Cost of Quarrying, Crushing, and Grinding Limestone at the Security Quarry of the North American Cement Corporation, Security, Md. Inf. Circ. 6554, 1932, 14 pp. In addition to describing methods of quarrying, crushing, and grinding at the plant, the report tells of the administrative and safety organizations and gives costs. The plan of the quarry and crushing plant and a flow sheet showing machinery, output, and material sizes are presented by figures.

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*Out of print.

*FULLERTON, W. J., and COX, A. W. Method and Cost of Quarrying, Crushing, and Grinding Limestone at Catskill Plant of North American Cement Corporation, Catskill, N.Y. Inf. Circ. 6522, 1931, 15 pp. Another of a series of papers describing practice and equipment and giving costs at various cement-plant quarries in the United States.

_____. Crushing and Grinding Limestone at the Howes Cave (N.Y.) Plant of the North American Cement Corporation. Inf. Circ. 6553, 1932, 7 pp. One of a series of papers discussing methods used in crushing and grinding materials for cement manufacture.

GANSER, J. W. Method and Cost of Quarrying Limestone at Quarry of Trinity Portland Cement Co., Fort Worth, Tex. Inf. Circ. 6513, 1931, 13 pp. One of a series of papers describing quarry methods and showing operating costs at cement-plant quarries throughout the United States. The paper includes sections on the history of the company, geology of the deposit, and administrative and safety organizations. Operations are illustrated by graphs.

_____. Method and Cost of Quarrying Limestone and Shale at the Quarry of the Trinity Portland Cement Co., Dallas, Tex. Inf. Circ. 6498, 1931, 12 pp. One of a series of papers describing mining and milling methods and costs at cement plants throughout the United States. Cost tabulations represent local operating expenditures and not total production costs.

HATMAKER, PAUL. Utilization of Dolomite and High-Magnesian Limestone. Inf. Circ. 6524, 1931, 18 pp. Gives the composition and properties of dolomite; covers briefly the particular field of dolomite and magnesium limestone; and discusses uses, occurrence, production, prices, and foreign trade. Includes a bibliography.

HEALTH AND SAFETY REPORTS. Published annually as soon after the close of the year as data are available. Contain advance statistical data of men employed, days of operation, man-hours of employment, and accidents at limestone quarries for the calendar year.

MANN, R. T. Methods and Costs of Quarrying, Crushing, and Grinding Limestone at Plant of Southwestern Portland Cement Co., El Paso, Tex. Inf. Circ. 6608, 1933, 14 pp. Gives details of treatment, equipment, and costs. Figures present a map of the quarry and part of the cement plant; a sampling map; a flow sheet of the crushing, drying, and raw-grinding departments; and a diagram of methods of sampling and blending before drying.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the stone industries, published annually as soon after the close of the year as figures are available. Include final production figures of dimension limestone, by uses, for the preceding year. Figures for Indiana oolitic limestone are given in a separate summary.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Stone. Published each year from 1924 to 1931 as a separate and also as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Include detailed statistics and a resumé of conditions in the limestone industries for the preceding year.

MINERALS YEARBOOK. Dimension stone. Published each year from 1932-33 to 1935 as a chapter of the volume. Volumes, $1.25, $1.75, and $2, respectively. Present preliminary statistics and a résumé of conditions in the limestone industry for the preceding year.

MINERALS YEARBOOK STATISTICAL APPENDIX. Stone. Published each year from 1932-33 to 1935 as a chapter of the volume and also as a separate. Separates, 5 cents; volumes, $1. Contain final statistics of the limestone industry for the preceding year.

*MORRISON, G. A. Mining and Crushing Methods and Costs at the West Penn Cement Co. Limestone Mine, West Winfield, Pa. Inf. Circ. 6446, 1931, 21 pp. One of a series of papers on mining methods and operating costs in recovering nonmetallic minerals. This paper reviews the history of operations at the plant. The double-entry system with rooms to right and left is now employed. Operations are illustrated by graphs.

QUARRY ACCIDENTS IN THE UNITED STATES. Published annually in bulletin form. Includes statistics of men employed, days of operation, man-hours of employment, and accidents at limestone quarries in each producing State for the calendar year.

ROBOTHAM, C. A. Mining Limestone by a Caving Method at Crestmore Mine of the Riverside Cement Co., Crestmore, Calif. Inf. Circ. 6795, 1934, 20 pp. Describes unusual method of underground mining practice, based upon technique employed in the copper mines of the Ray and Globe-Miami districts of Arizona. Figures show plan of development, shaft and tipple system, undercut caving method, section through undercut caving method, and various other details of the plant.

THOENEN, J. R. Underground Limestone Mining. Bull. 262, 1926, 100 pp. 30 cents. Discusses factors that make mining methods feasible and the advantages and disadvantages derived from the pursuit of such methods. Describes mining methods and equipment and includes a section on costs.

_____. Study of Quarry Costs. Rept. of Investigation 2911, 1929, 12 pp. Tabulates results of a survey of operating costs at quarries as derived from figures submitted to the Bureau by certain operators.

TOWNSEND, R. H. Method and cost of Quarrying Limestone at Plant of Calaveras Cement Co., San Andreas, Calif. Inf. Circ. 6610, 1933, 11 pp. Discusses mining, transporting, and crushing methods; describes equipment used; and shows operating expenditures.

TREMOUPEUX, R. E. Quarrying Methods and Costs at the Sloan Quarry of the United States Lime Products Corporation, Sloan, Nev. Inf. Circ. 6599, 1932, 8 pp. One of a series of papers designed to disseminate information regarding methods and costs at various quarries throughout the United States.

Technical-press publications:

BERGER, E. E. Effect of Steam on the Decomposition of Limestone. Ind. and Eng. Chem., vol. 19, May 1927, pp. 594-596.

BOWLES, OLIVER. Stripping Problems at Limestone Quarries, Eng. and Contr. (Ry.), vol. 58, Nov. 15, 1922, pp. 93-96.

_____. Stripping Problems in Limestone Quarries of Shenandoah Valley. Concrete, mill. sec., vol. 22, January 1923, suppl., pp. 5-7.

_____. Limestone Mined to Advantage. Cement, Mill, and Quarry, vol. 24, May 5, 1924, pp. 23-27.

_____. Quarrying and Preparing Limestone in America. Quarry Managers' Jour., vol. 18, July 5, 1935, pp. 139-142.

_____. Use of Limestone in the Iron and Steel Industry. Rolling Mill Jour., vol. 5, February 1931, pp. 87-90; March 1931, pp. 167-170; April 1931, pp. 247-250.

CRAWFORD, F. S. How the Michigan Limestone and Chemical Company Won "Sentinels of Safety." Explosives Eng., vol. 9, February 1931, pp. 49-52.

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*Out of print.

FURNAS, C. C. Rate of Calcination of Limestone. Ind. and Eng. Chem., vol. 23, May 1931, pp. 534-538; Rock Products, vol. 34, June 20, 1931, pp. 32-35.

HARRINGTON, D. Safety in Limestone Mining and Quarrying. Trans. Nat. Safety Council, 1932, pp. 152-153.

NEWSOM, J. B., and BOWLES, OLIVER. A New Adaptation of the Wire Saw. Eng. and Min. Jour., vol. 134, December 1933, pp. 506-508.

Magnesite

Bureau publications:

BOWLES, OLIVER, and JUSTICE, C. W. Growth and Development of the Nonmetallic Mineral Industries. Inf. Circ. 6687, 1933, 50 pp. A condensed 52-year history of the principal nonmetallic-mineral industries, with charts showing the relation of nonmetallic minerals to the building trades, highway construction, population, and industrial production. Contains a table showing annual production value of crude magnesite. The accompanying text covers developments in production and usage.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the magnesite industry, published annually as soon after the close of the year as figures are available. Contain final figures for the year.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Magnesium and Its Compounds. Published each year from 1924 to 1931 as a separate and also as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Include detailed statistics and a résumé of conditions in the magnesite industry for the preceding year.

MINERALS YEARBOOK. Magnesium and Its Compounds. Published each year from 1932-33 to 1935 as a chapter of the volume and also as a separate. Separates, 5 cents; volumes, $1.25, $1.75, and $2, respectively. Contain final statistics and a résumé of conditions in the magnesite industry for the preceding year. Before 1932-33 Minerals Yearbook was published as Mineral Resources of the United States.

*PHALEN, W. C. The Magnesite Industry in Austria. Rept. of Investigations 2015, 1919, 4 pp. Gives location of Austrian deposits and the composition of the material and describes methods of mining and preparation.

*RALSTON, O. C., PIKE, R. D., and DUSCHAK, L. H. Plastic Magnesia. Bull. 236, 1925, 111 pp. Gives results of tests made with Chewelah and other magnesites at the laboratories of the University of California in an endeavor to produce a plastic magnesia that would be satisfactory for making the so-called Sorel cement composition flooring, stucco, and plaster.

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*Out of print.

TYLER, P. M. Consumption and Prices of Nonmetallic Minerals. Inf. Circ. 6794, 1934, 50 pp. Summarizes consumption data for pre-war and post-war periods; discusses trend toward national self-sufficiency, prices, and the effects of the depression; and gives tables for the principal nonmetallic-mineral commodities, listing domestic production, imports, apparent consumption, and indexes of consumption and unit value from 1910 to 1935. A table for magnesite is included.

_____. Magnesite. Inf. Circ. 6437, 1931, 53 pp. Magnesite production and utilization are considered from an international standpoint. Serious economic problems are encountered in the United States because the chief deposits are near the West coast and consumption is centered largely in the East. The report describes domestic and foreign deposits; gives information on methods of mining and treatment; and lists producers and importers and dealers. A bibliography is added.

Technical-press publications:

DUSCHAK, L. H. Extraction of Calcium Oxide from Calcined Magnesite. Chem. and Met. Eng., vol. 23, Sept. 29, 1920, p. 628.

RIDDELL, W. C. Analysis of Magnesite. Min. and Sci. Press., vol. 120, June 26, 1920, pp. 943-944.

TYLER, P. M. Magnesite. Mineral Industry, vol. 37, 1928, pp. 389-399; vol. 38, 1929, pp. 412-423; vol. 39, 1931, pp. 385-398.

Marble

Bureau publications:

*BOWLES, OLIVER. The Technology of Marble Quarrying. Bull. 106, 1916, 174 pp. A comprehensive treatise on marble quarrying and finishing. Contains a preliminary discussion of the origin, composition, and physical properties of marble affecting workability and use and follows with a detailed account of efficient and economical methods of quarrying and finishing. Describes special and improved machinery, discusses the problem of waste, and in conclusion stresses the need of better records and cost-keeping systems and presents general types in use.

_____. Significant Features of Wire-Saw Operation in Europe. Inf. Circ. 6483, 1931, 3 pp. Reviews the extent to which wire saws are used in the marble quarries of Italy, France, and Belgium; compares European and American practice; and gives data on costs and rates of sawing.

BOWLES, OLIVER, and BANKS, D. M. Marble. Inf. Circ. 6313, 1930, 20 pp. An abstract of Bulletin 106 on marble quarrying, with additional information as to distribution of marble in the United States, production, marketing, prices, and foreign trade. Includes a bibliography.

_____. Onyx Marble and Travertine. Inf. Circ. 6751, 1933, 11 pp. Defines the terms "onyx" and "travertine" and discusses the origin, occurrence, and uses of each. Describes domestic and foreign deposits of commercial importance. The most important deposit of onyx is in Mexico and of travertine in Italy.

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*Out of print.

HEALTH AND SAFETY REPORTS. Published annually in mimeographed form as soon after the close of the year as data are available. Contain advance statistical data of men employed, days of operation, man-hours of employment, and accidents at marble quarries for the calendar year.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the stone industries, published annually as soon after the close of the year as figures are available. Include final production figures of dimension marble, by uses, for the preceding year.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Stone. Published each year from 1924 to 1931 as a separate and also as a chapter of the volume. Separates, 5 cents; volumes, \$1-\$1.50. Before 1924 these publications were issued by the United States Geological Survey. Include detailed statistics and a résumé of conditions in the marble industry for the preceding year.

MINERALS YEARBOOK. Dimension Stone. Published each year from 1932-33 to 1935 as a chapter of the volume. Volumes, \$1.25, \$1.75, and \$2, respectively. Presents preliminary statistics and a résumé of conditions in the marble industry for the preceding year.

MINERALS YEARBOOK STATISTICAL APPENDIX. Stone. Published each year from 1932-33 to 1935 as a chapter of the volume and also as a separate. Separates, 5 cents; volumes, \$1. Contain final statistics of the marble industry for the preceding year.

QUARRY ACCIDENTS IN THE UNITED STATES. Published annually in bulletin form. Include statistics of men employed, days of operation, man-hours of employment, and accidents at marble quarries in each producing State for the calendar year.

Cooperative publications:

ǂ GORDON, C. H., DALE, T. N., and BOWLES, OLIVER. Marble Deposits of East Tennessee. Tennessee Division of Geology Bull. 28, 1924, 264 pp. A comprehensive treatise on the marbles of East Tennessee, divided into three parts. Part I gives a historical sketch of quarry operations in this section, covers the origin and occurrence of the marble, and gives the geology of the various areas and a general description of the quarries of each area. Part II describes surficial features, structure of the beds, the physical and chemical qualities of the marbles, and the characteristics that determine their adaptability. Part III discusses the imperfections of marble; outlines factors that affect quarrying methods and a general plan for quarrying; describes successive quarry operations, such as channeling, drilling, wedging, removing key blocks, and hoisting, and the types of machinery employed for each; describes milling operations; and contains also a lengthy discussion of the waste problem.

Mineral Wool

Bureau publications:

MINERALS YEARBOOK, 1935. Minor Nonmetals. Published as a chapter of the volume and also as a separate. Separate, 5 cents; volume, \$2. Contains a section on mineral wool, which presents a résumé of conditions in the industry for the preceding year.

ǂObtainable from the Tennessee Division of Geology, Nashville, Tenn.

THOENEN, J. R. Mineral Wool. Inf. Circ. 6142, 1929, 13 pp. Recounts the history of the mineral-wool industry, describes the operations of several plants, and explains mining and manufacturing practices and uses of the material.

Sand

Bureau publications:

FAHRENWALD, A. W., and THOM, CLARENCE. Coarse Sand Flotation, Classification, and Table Concentration. Rept. of Investigations 2921, 1929, 7 pp. Discusses a concentration process embodying flotation, classification, and tabling. The process was developed for the treatment of Michigan amygdaloid copper ores, and the report is made up largely of tables presenting metallurgical data and screen analyses.

* LADOO, R. B. Silica. Rept. of Investigations 2307, 1922, 7 pp. Lists forms of silica used industrially, briefly discusses mining and milling methods, and outlines uses.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the sand and gravel industry, published as soon after the close of the year as data are available. Contain final figures of production of sand, by kinds, for the year.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Silica. Published each year from 1924 to 1931 as a separate and also as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Include detailed statistics and a résumé of conditions in the sand industry for the preceding year.

MINERALS YEARBOOK. Sand and Gravel. Published each year from 1932-33 to 1935 as a chapter of the volume. Volumes, $1.25, $1.75, and $2, respectively. Include preliminary statistics and a resume of conditions in the sand industry for the preceding year.

MINERALS YEARBOOK STATISTICAL APPENDIX. Sand and Gravel. Published each year from 1932-33 to 1935 as a chapter of the volume and also as a separate. Separates, 5 cents; volumes, $1. Include final statistics of the sand industry for the preceding year.

SANTMYERS, R. M. Quartz and Silica - Part I: General Summary. Inf. Circ. 6472, 1931, 15 pp. The first of a series of circulars on quartz and silica. Describes the various varieties of silica and the physical and chemical properties of each variety, classified according to use. Also gives production and import data.

_____. Quartz and Silica - Part II: Quartz, Quartzite, and Sandstone. Inf. Circ. 6473, 1931, 20 pp. The second of a series of circulars on quartz and silica. Sections on the use of quartz as filler in certain building materials and as dimension stone are included.

_____. Quartz and Silica - Part III: Sand and Miscellaneous Silicas. Inf. Circ. 6474, 1931, 17 pp. The final paper of the series on quartz and silica. Uses are classified in tabular form and a section is devoted to sand used in construction.

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*Out of print

TYLER, P. M. Consumption and Prices of Nonmetallic Minerals. Inf. Circ. 6794, 1934, 50 pp. Summarizes consumption data for pre-war and post-war periods; discusses trend toward national self-sufficiency, prices, and the effects of the depression; and presents tables for the principal nonmetallic-mineral commodities, listing domestic production, net imports or exports, apparent consumption, and indexes of consumption and unit value from 1910 to 1935. A table for sand-lime brick is included.

*WEIGEL, W. M. Special Sands. Rept. of Investigations 2646, 1924, 9 pp. Includes data on special flooring and roofing sands.

_____. Technology and Uses of Silica and Sand. Bull. 266, 1927, 199 pp. 40 cents. A comprehensive treatise on silica and sand. Describes the mineralogical and commercial forms of silica and devotes a section to the occurrence, mining, preparation, and utilization of each form. Bibliographies are included under several sections.

Technical-press publications:

WEIGEL, W. M. Special Sands as By-Products of the Average Commercial Plants. Rock Products, vol. 29, Feb. 6, 1926, pp. 40-41.

_____. Preparation and Use of Industrial Special Sands. Trans. Am. Inst. Min. Met. Eng., vol. 73, 1926, pp. 434-448; Abs., Min. and Met., vol. 7, March 1926, p. 139.

Sand and Gravel

Bureau publications:

BOWLES, OLIVER, and JUSTICE, C. W. Growth and Development of the Nonmetallic Mineral Industries. Inf. Circ. 6687, 1933, 50 pp. A condensed 52-year history of the principal nonmetallic-mineral industries, with charts showing the relation of nonmetallic minerals to the building trades, highway construction, population, and industrial production. Contains a table showing annual production value of sand and gravel for the period covered. The accompanying text covers developments in usage and methods of preparation.

DANA, ANDERSON. Methods and Costs of Mining and Preparing Gravel and Sand for Market at the Plant of the Seaboard Sand and Gravel Corporation, Port Jefferson, N.J. Inf. Circ. 6592, 1932, 12 pp. One of a series of papers designed to disseminate information regarding mining and treatment methods and costs at sand and gravel plants throughout the country.

DUFFY, J. H. Methods and Costs of Dredging Sand and Gravel by the Ohio River Sand Co., Louisville, Ky. Inf. Circ. 6421, 1931, 17 pp. The first of a series of papers describing dredging methods and costs in recovering sand and gravel from the beds of rivers throughout the United States. Deals directly with a plant that operated two ladder-type dredges in recovering sand and gravel from the bed of the Ohio River near Louisville, Ky.

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*Out of print.

DUNNING, J. S. Method and Cost of Mining Sand and Gravel at the Farmington (Conn.) Plant of the Atlas Sand, Gravel, & Stone Co. Inf. Circ. 6676, 1933, 9 pp. One of a series of papers designed to disseminate information regarding mining and treatment methods and costs at sand and gravel plants throughout the country. The plant described is a dry-land operation of especial interest because its present methods of handling the material were developed by a series of radical changes, each of which effected greater economy and increased the quality and quantity of the product.

DWYER, DENIS. Mining, Treatment, Methods, and Costs at Western Indiana Gravel Co's. Plant No. 1, LaFayette, Ind. Inf. Circ. 6692, 1933, 13 pp. One of a series of papers designed to disseminate information regarding mining and treatment methods and costs at sand and gravel plants throughout the country.

FIELDNER, A. C., and EMERY, A. H. Research Activities in the Mineral Industries of the United States. Inf. Circ. 6637, 1932, pp. 152-154. A catalogue of research activities conducted by various agencies in the United States. Problems on sand and gravel are listed under the section Sand, Gravel, and Crushed Stone.

HADDOW, HUGH, JR. Mining, Treatment, Methods, and Costs, Menantico Sand & Gravel Co., Millville, N.J. Inf. Circ. 6420, 1931, 11 pp. One of a series of papers on methods of mining nonmetallic minerals. Describes methods of recovering and treating sand and gravel at a plant that has resorted to hydraulic means of sizing fine sand and tells of the preparation of sand and gravel for a number of special markets. Has especial interest for operators who have a surplus of fine sand.

HEALTH AND SAFETY REPORTS. Sand and Gravel Producers' Safety Contest. Published annually in mimeographed form. Include data on the annual safety contest and statistics of man-hours of employment and accidents at certain sand and gravel pits for the calendar year.

JUMPER, H. D. Mining, Treatment Methods, and Costs at Plant of Consolidated Rock Products Co., Durbin, Calif. Inf. Circ. 6607, 1933, 21 pp. One of a series of papers designed to disseminate information regarding mining, treatment methods, and costs at sand and gravel plants throughout the country.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the sand and gravel industry, published annually as soon after the close of the year as data are available. These reports furnish final figures for the year.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Sand and Gravel. Published each year from 1924 to 1931 as a separate and later as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Include detailed statistics and a résumé of conditions in the sand and gravel industry for the preceding year.

MINERALS YEARBOOK. Sand and Gravel. Published each year from 1932-33 to 1935 as a chapter of the volume. Volumes $1.25, $1.75, and $2, respectively. Present preliminary statistics and a résumé of conditions in the sand and gravel industry for the preceding year. Before 1932-33 Minerals Yearbook was published as Mineral Resources of the United States.

MINERALS YEARBOOK STATISTICAL APPENDIX. Sand and Gravel. Published each year from 1932-33 to 1935 as a chapter of the volume and also as a separate. Separates, 5 cents; volumes, $1. Contain final statistics of the sand and gravel industry for the preceding year.

PERKINS, O. E. Dredging Methods and Costs of Ross Island Sand and Gravel Co., Portland, Oreg. Inf. Circ. 6696, 1933, 11 pp. One of a series of papers designed to disseminate information regarding mining and treatment methods and costs at sand and gravel plants throughout the country. This paper deals especially with methods and costs of dredging, classifying, and transporting.

POPPLEWELL, T. E. Mining Methods and Costs at the Hart Spur Pit of the Fort Worth Sand & Gravel Co., Inc., Fort Worth, Tex. Inf. Circ. 6652, 1932, 12 pp. One of a series of papers designed to disseminate information regarding mining and treatment methods and costs at sand and gravel plants throughout the country. Reviews the history of the operation discussed, gives the geology of the deposit, describes methods, tells of the administrative and safety organizations, and gives a summary of operating costs in tabular form. Operations and equipment are illustrated by graphs.

PUARIEA, H. F. Method and Cost of Dredging Sand and Gravel, Portland Gravel Co., Portland, Oreg. Inf. Circ. 6626, 1932, 7 pp. One of a series of papers designed to disseminate information regarding mining and treatment methods and costs at sand and gravel plants throughout the country. Describes methods employed in operating a clamshell dredge on the Willamette River and a pump dredge on the Columbia River.

THOENEN, J. R. Economics of New Sand and Gravel Developments. Econ. Paper 7, 1929, 60 pp. 15 cents. Presents the economic factors that require study by prospective operators of sand and gravel deposits. Also presents a brief pictorial history of the sand and gravel business for the past 20 years. An extensive bibliography follows the text.

_____. Prospecting and Exploration for Sand and Gravel. Inf. Circ. 6668, 1932, 52 pp. The first of a series of papers summarizing technical problems involved in the production and preparation of sand and gravel. Describes the various modes of occurrence of sand and gravel and the methods by which each may be prospected or explored before expending funds for development.

_____. Development of Sand and Gravel Deposits. Inf. Circ. 6689, 1933, 51 pp. Discusses the economic and physical features, such as size, shape, thickness, drainage, and overburden, affecting development of sand and gravel deposits. Outlines and illustrates with graphs methods of developing bank, pit, and marine deposits and cites typical examples. A bibliography is included.

_____. Sand and Gravel Excavation - Part I: The Power Shovel, the Dragline Excavator, and the Excavator Crane. Inf. Circ. 6798, 1934, pp. 1-44. The third of the series of papers on the production and preparation of sand and gravel. Part I considers problems arising in the excavation of sand and gravel and their delivery to the treatment plant. Such features as structural limitations, service equipment required, capacities, working ranges, weights and power plants, range of shovel cycles, and time of cycles are discussed in detail.

THOENEN, J. R. Sand and Gravel Excavation - Part II: Power Scraper, Slackline Cableway Excavator, and Hydraulic Giant. Inf. Circ. 6814, 1934, pp. 45-96. A continuation of the sand and gravel study. Considers the performance of certain types of equipment and illustrates them by graphs.

_____. Sand and Gravel Excavation - Part III: Hydraulic Dredge, Clamshell Dredge. Ladder Dredge, and Dipper Dredge. Inf. Circ. 6826, 1935, pp. 97-132. The third paper of a series on sand and gravel excavation problems discusses the use of various types of dredges. The plan and elevation of the dredges are illustrated.

_____. Sand and Gravel Excavation - Part IV: Car and Locomotive Haulage: Hoist and Rope Haulage: Remote-Control Haulage. Inf. Circ. 6856, 1935, pp. 133-179. Discusses haulage equipment in general and the use of industrial cars with locomotives or hoists as the motive power in particular. Includes data on such features as locomotive power, condition of track, tractive effort and time required, characteristics of standard hoisting rope, and gravity and friction components of loads on inclines.

_____. Sand and Gravel Excavation - Part V: Motor-Truck Haulage, Conveyor-Belt Haulage, Pumps and Pipe Lines, Barges and Towboats, Serial Trams. Inf. Circ. 6875, 1936, pp. 179-252. Discusses both intraplant and interplant haulage equipment, with special attention to structural limitations and capacity.

_____. Sand and Gravel Excavation - Part VI: Mining Methods. Inf. Circ. 6879, 1936, 46 pp. Concludes series of papers on sand and gravel excavation, with explanation of mining methods.

TYLER, P. M. Consumption and Prices of Nonmetallic Minerals. Inf. Circ. 6794, 1934, 50 pp. Summarizes consumption data for pre-war and postwar periods; discusses trend toward national self-sufficiency, prices, and the effects of the depression; and presents tables for the principal nonmetallic commodities, listing domestic production, imports, apparent consumption, and indexes of consumption and unit value from 1910 to 1935. A table for sand and gravel is included.

WARD, F. L. Methods and Costs of Mining and Preparing Sand and Gravel at the Plant of the Ward Sand & Gravel Co., Oxford, Mich. Inf. Circ. 6580, 1932, 16 pp. Describes a dredging operation with many unique features; especially noteworthy are the method of mining the sand and gravel with hydraulic jets operating on the principle of a water ejector, the unusual construction of the dredge and the self-unloading barges that tend it, the transportation of the sand and gravel to shore in barges instead of in pipe lines, the large storage capacity of the plant, and the fact that all material goes into storage before being shipped.

WILLIAMSON, G. H. Sand and Gravel Dredging Methods and Costs of J. K. Davidson & Bro., Pittsburgh, Pa. Inf. Circ. 6582, 1932, 10 pp. One of a series of papers designed to disseminate information regarding mining and treatment methods and costs at sand and gravel plants throughout the country.

WINDROW, R. L. Methods and Costs of Mining and Preparing Sand and Gravel at the Clowdy Plant of the Dallas Washed & Screened Gravel Co., Dallas, Tex. Inf. Circ. 6581, 1932, 10 pp. One of a series of papers designed to disseminate information regarding mining and treatment methods and costs at sand and gravel plants throughout the country.

Technical-press publications:

ADAMS, W. W. Benefits of Safety Campaigns in the Mineral Industries. Proc. Nat. Sand and Gravel Assoc., 1929; Rock Products, vol. 32, Jan. 19, 1929, pp. 77-78; Abs., Pit and Quarry, vol. 17, Mar. 13, 1929, pp. 91-92.

_____. National Sand and Gravel Safety Contest, 1929. Nat. Sand and Gravel Bull., vol. 11, Apr. 15, 1930, p. 51; Pit and Quarry, vol. 22, Apr. 23, 1930, pp. 59-60.

_____. National Sand and Gravel Safety Contest, 1930. Nat. Sand and Gravel Bull., vol. 12, Sept. 15, 1931, p. 5.

_____. Sand and Gravel Safety Contest of 1931. Rock Products, vol. 35, Aug. 27, 1932, p. 20; Nat. Sand and Gravel Bull., vol. 13, Aug. 15, 1932, p. 3.

HUGHES, H. H. Sand and Gravel Exceeds That of All Nonmetallics except Fuels. Pit and Quarry, vol. 25, May 1933, pp. 25-30.

PUARIEA, H. F. Method and Cost of Dredging Sand and Gravel, Portland Gravel Co., Portland, Oregon. Rock Products, vol. 35, July 16, 1932, pp. 11-14.

THOENEN, J. R. Progress in the Sand and Gravel Industry. Rock Products, vol. 32, Jan. 5, 1929, pp. 64-65.

_____. Economics of New Sand and Gravel Developments. Nat. Sand and Gravel Assoc. Bull., vol. 11, May 1930, p. 10.

Sandstone

Bureau publications:

BOWLES, OLIVER. Sandstone Quarrying in the United States. Bull. 124, 1917, 143 pp. 25 cents. A comprehensive treatise on the subject, designed to indicate in a general way the location of workable deposits of sandstone in the United States and to outline the most efficient and economical methods of quarrying and preparing the rock for structural and other purposes. Describes varieties and properties of sandstone, methods of prospecting, quarrying, and finishing, and discusses causes, prevention, and use of waste material. Bluestone and ganister are discussed in the same way.

CRANE, W. R. Red Iron Ores and Ferruginous Sandstones of the Clinton Formation in the Birmingham District, Alabama. Tech. Paper 377, 1926, 41 pp. 10 cents. A description of the material in the four ore beds of Red Mountain.

HEALTH AND SAFETY REPORTS. Published annually in mimeographed form as soon after the close of the year as data become available. Furnish advance statistical data of men employed, days of operation, man-hours of employment, and accidents at sandstone and bluestone quarries for the calendar year.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the stone industries, published annually as soon after the close of the year as figures become available. Include final production figures of dimension sandstone, by uses, for the preceding year.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Stone. Published each year from 1924 to 1931 as a separate and also as a chapter of the volume. Separates, 5 cents; volumes, \$1-\$1.50. Before 1924 these publications were issued by the United States Geological Survey. Include detailed statistics and a résumé of conditions in the sandstone industry for the preceding year.

MINERALS YEARBOOK. Dimension Stone. Published each year from 1932-33 to 1935 as a chapter of the volume. Volumes, \$1.25, \$1.75, and \$2, respectively. Present preliminary statistics and a résumé of conditions in the sandstone industry for the preceding year.

MINERALS YEARBOOK STATISTICAL APPENDIX. Stone. Published each year from 1932-33 to 1935 as a chapter of the volume and also as a separate. Separates, 5 cents; volumes, \$1. Contain final statistics of the sandstone industry for the preceding year.

QUARRY ACCIDENTS IN THE UNITED STATES. Published annually in bulletin form. Include statistics of men employed, days of operation, man-hours of employment, and accidents at sandstone quarries in each producing State for the calendar year.

SANTMYERS, R. M. Quartz and Silica - Part II: Quartz, Quartzite, and Sandstone. Inf. Circ. 6473, 1931, 20 pp. Includes a brief discussion of the use of sandstone and quartzite for building purposes.

THOENEN, J. R. Study of Quarry Costs - Trap Rock, Sandstone, Granite. Inf. Circ. 6291, 1930, 24 pp. This report shows costs of various operations at sandstone quarries, based on total tonnages sold in the calendar year 1927 as reported to the Bureau by operators.

Slate

Bureau publications:

*BOWLES, OLIVER. Slate Mining in Maine. Rept. of Investigations 2181, 1920, 3 pp. A brief description of the slate of the Monson (Maine) district and of the mining methods employed.

*______. The Utilization of Waste Slate as a Filler. Rept. of Investigations 2283, 1921, 5 pp. A report of cooperative work of the Bureau and certain manufacturing companies to test the suitability of pulverized slate as filler in rubber, linoleum, oilcloth, window shades, and plastic roofing and flooring. Results indicated that the material may be used advantageously in mechanical rubber goods and in some grades of oilcloth, floor covering, and window shades. Apparently it is not adapted for use in rubbers of a grade used in automobile tires. It has been used for a long time in plastic roofing and flooring containing coal tar.

*______. Slate as a Permanent Roofing Material. Rept. of Investigations 2267, 1921, 5 pp. Brings to the attention of producers certain modifications in the manufacture and classification of slate that would encourage its wider use. Emphasizes the enduring qualities of the material and the importance of its being laid properly.

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*Out of print.

BOWLES. Slate Dust in Asphalt Road-Surface Mixtures. Rept. of Investigations 2230, 1921, 6 pp. Gives results of laboratory tests of road-asphalt mixtures in which slate flour is used as filler. The tests indicated that the use of slate flour as filler in asphalt road-surface mixtures would result in improved highways, but the author recommends that these tests be verified by practical tests on experimental roads.

_____. The Technology of Slate. Bull. 218, 1922, 132 pp. 20 cents. A comprehensive treatise on the most efficient methods and equipment used in quarrying and preparing slate. Includes sections on properties, deposits, uses, and waste utilization. A bibliography is added.

_____. Drilling and Broaching in Slate Quarries. Rept. of Investigations 2532, 1923, 6 pp. Describes method of cutting slate by drilling and broaching as substitutes for blasting and channeling. These methods were adopted in an attempt to reduce the percentage of waste material.

_____. Recent Progress in Slate Technology. Rept. of Investigations 2766, 1926, 9 pp. Records developments in slate technology since publication of Bulletin 218. Mills for the manufacture of roofing slate are described in detail and illustrated by graphs. Among other developments are the use of gang saws for sawing, air-driven slate splitters, power-driven punching machines, trimming machines, slate-veneered shingles, and a new slate product called "Struco."

_____. The Wire Saw in Slate Quarrying - Preliminary Report. Rept. of Investigations 2820, 1927, 10 pp. The wire saw is essentially a 3-strand wire cable running as an endless belt. Sand fed to it with a small stream of water is caught in the grooves of the cable and acts as an abrasive for cutting the rock as it comes in contact with the wire. This equipment was introduced to the slate industry by the Bureau of Mines late in 1926. Preliminary tests of its operation indicated that it would cut about twice as fast as a channeling machine and at about two-fifths of the cost per square foot.

_____. The Wire Saw in Slate Quarrying - Second Supplementary Rept. Rept. of Investigations 2918, 1929, 7 pp. A further description of the wire saw and its operation in the quarry.

_____. A System of Accounts for the Slate Industry. Rept. of Investigations 2971, 1929, 25 pp. Stresses the importance of cost-keeping and presents a system of accounts for the consideration of operators.

_____. The Wire Saw in Slate Quarrying. Tech. Paper 469, 1930, 37 pp. 15 cents. A paper embodying information contained in three earlier reports of the introduction and operation of wire saws in slate quarries. Illustrations are shown of the equipment, and all details of operation, advantages, and costs are explained. The use of wire saws in cutting slate is considered a great advancement in quarry efficiency and economy. By 1929 most of the slate quarries of Pennsylvania were equipped with one or more saws. It is estimated that the new process has accomplished through low power and labor charges and conservation of time and material an annual saving to the Pennsylvania slate industry of at least a quarter of a million dollars.

_____. Significant Features of Wire-Saw Operation in Europe. Inf. Circ. 6483, 1931, 3 pp. Reviews the extent to which wire saws are used in Italy, France, and Belgium, compares European and American practice, and gives data on costs and rates of sawing.

BOWLES. Consumption Trends in the Roofing-Slate Industry. Rept. of Investigations 3221, 1933, 3 pp. Shows the history of roofing-slate production and consumption by means of figures and compares sales and prices with other roofing and building materials. Analyzes conditions that have affected the growth of the slate industry.

HEALTH AND SAFETY REPORTS. Published annually in mimeographed form as soon after the close of the year as data are available. Contain advance statistical data of men employed, days of operation, man-hours of employment, and accidents at slate quarries for the calendar year.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the slate industry for the preceding year. The first issue, published soon after the close of the year, gives preliminary statistics, and the second issue, published later in the year, contains final statistics.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Slate. Published each year from 1924 to 1931 as a separate and later as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Include detailed statistics and a résumé of conditions in the slate industry for the year.

MINERALS YEARBOOK. Dimension Stone. Published in 1932-33 as a chapter of the volume. Volume, $1.25. Includes preliminary statistics and a résumé of conditions in the slate industry for the preceding year. Before 1932-33 Minerals Yearbook was published as Mineral Resources of the United States.

_____. Slate. Published in 1934 and 1935 as a chapter of the volume and also as a separate. Separates, 5 cents; volumes, $1.75 and $2, respectively. Present final statistics and a resume of conditions in the slate industry for the preceding year.

MINERALS YEARBOOK STATISTICAL APPENDIX. Slate. Published as a chapter of the 1932-33 volume and also as a separate. Separate, 5 cents; volume, $1. Contains final statistics of the slate industry for the preceding year.

QUARRY ACCIDENTS IN THE UNITED STATES. Published annually in bulletin form. Include statistics of men employed, days of operation, man-hours of employment, and accidents at slate quarries in each producing State for the calendar year.

* THOENEN, J. R. The Wire Saw in Slate Quarrying - Supplementary Report. Rept. of Investigations 2851, 1928, 8 pp. A second account of the successful operation of the wire saw in the slate quarries of Pennsylvania.

TYLER, P.M. Consumption and Prices of Nonmetallic Minerals. Inf. Circ. 6794, 50 pp. Summarizes consumption data for pre-war and post-war periods; discusses trend toward national self-sufficiency, prices, and the effects of the depression; and presents tables for the principal nonmetallic commodities, listing domestic production, net imports or exports, apparent consumption, and indexes of consumption and unit value. A table for slate from 1910 to 1935 is included.

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*Out of print.

Technical-press publications:

BOWLES, OLIVER. Characteristics of Slate. Proc. Am. Soc. Test. Mat., vol. 23, 1923, pp. 524-534.

_____. Slate in 1923. Cement, Mill, and Quarry, vol. 24, Feb. 20, 1924, pp. 74-75.

_____. Slate Mining - Technical Progress. Eng. and Min. Jour.-Press, vol. 117, Apr. 12, 1924, pp. 605-609.

_____. Slate. Marketing of Metals and Minerals. McGraw-Hill Book Co., 1925, pp. 524-529.

_____. Slate Industry in 1925. Rock Products, vol. 28, Dec. 26, 1925, pp. 142-143.

_____. Slate in 1928. Rock Products, vol. 31, Dec. 22, 1928, pp. 167-168.

_____. Wire as a Tool for Mining Slate. Eng. and Min. Jour., vol. 125, Mar. 24, 1928, pp. 484-486.

_____. The Wire Saw in Slate Quarries. Struco Slate Rev., 2d ed., 1929, pp. 21-22.

_____. Fundamental Factors in the Testing of Mineral Products with Special Reference to Slate and Related Materials. Proc. Am. Soc. Test. Mat., vol. 29, pt. 2, 1929, pp. 902-908.

_____. Slate in 1929. Rock Products, vol. 33, Jan. 4, 1930, p. 152.

_____. Slate as a Material of Construction. Struco Slate Rev., spring no., 1931, pp. 8-9.

_____. Slate in 1930. Rock Products, vol. 34, Jan. 3, 1931, p. 115.

_____. Slate Producers Reduce Costs as well as Prices. Rock Products, vol. 35, Jan. 9, 1932, pp. 78-80.

THOENEN, J. R. Slate in 1927. Rock Products, vol. 30, ann. rev. no., January 1928. p. 116.

Soapstone

Bureau publications:

BOWLES, OLIVER, and JUSTICE, C. W. Growth and Development of the Nonmetallic Mineral Industries. Inf. Circ. 6687, 1933, 50 pp. A condensed 52-year history of the principal nonmetallic-mineral industries. Statistics of production value of talc and soapstone are tabulated.

*HUGHES, H. H. Soapstone. Inf. Circ. 6563, 1932, 18 pp. Describes the composition, properties, and uses of soapstone, an impure, massive talcose rock, and gives geographical distribution of deposits. Almost the entire production is from Nelson County, Va. The industry of this district is described under the headings Prospecting, Quarrying, Milling, Markets, Prices, and Production.

*LADOO, R. B. Talc and Soapstone. Rept. of Investigations 2142, 1920, 5 pp. Discusses properties of talc and soapstone and stresses necessity for standard tests and grades.

* _____. The Uses of Talc and Soapstone. Rept. of Investigations 2127, 1920, 9 pp. Gives uses in outline form.

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*Out of print.

* LADOO. Soapstone. Rept. of Investigations 2327, 1922, 4 pp. Gives general information on properties, occurrence, production, mining and milling methods, and utilization.

_____. Talc and Soapstone - Their Mining, Milling, Products, and Uses. Bull. 213, 1923, 133 pp. A comprehensive treatise that includes a discussion of geological distribution, quarrying, milling, and uses of block soapstone.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Talc and Soapstone. Published each year from 1924 to 1931 as a separate and later as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Contain detailed statistics and a résumé of conditions in the soapstone industry for the preceding year.

Technical-press publications:

BOWLES, OLIVER. Talc and Soapstone. Mineral Industry, vol. 39, 1931, pp. 572-578; vol. 40, 1932, pp. 520-525.

_____. Talc and Soapstone Finding New Markets. Rock Products, vol. 35, Jan. 9, 1932, p. 75.

HUGHES, H. H. The Soapstone City. Rock Products, vol. 35, Feb. 13, 1932, pp. 25-28.

LADOO, R. B. Uses of Talc and Soapstone. Chem. and Met. Eng., vol. 23, no. 6, 1920, pp. 235-236.

_____. Marketing Soapstone. Eng. and Min. Jour., vol. 113, June 17, 1922, pp. 1049-1050.

WILSON, HEWITT, and PASK, J. A. Talc and Soapstone in Washington. Am. Inst. Min. and Met. Eng. Contribution 99-H, 1936, 25 pp.

Stone

Bureau publications:

ADAMS, W. W., and OTHERS. The National Safety Competition. Published annually as a Report of Investigations. Furnishes data on the National Safety Competition conducted by the Bureau, including statistics of man-hours of employment and accidents at certain stone quarries for the calendar year. Announces winners and reviews records achieved in various classes of open-cut mines and quarries for the year. Winners are awarded the trophies "Sentinels of Safety."

BOWLES, OLIVER. Safety in Stone Quarrying. Tech. Paper 111, 1915, 48 pp. 10 cents. Calls attention to the chief sources of accidents in quarries - haulage, falls or slides of quarry material, and explosives - as indicated by an analysis of accidents investigated and cites typical accidents. Describes equipment and methods that might be adopted as safety measures.

_____. A Fatal Quarry Accident from Falling Rock. Rept. of Investigations 2299, 1921, 2 pp. Describes an accident in a cement-plant quarry in Pennsylvania and urges need of special care in blasting where inclined open bedding planes are encountered.

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*Out of print.

BOWLES. The Economics of Crushed-Stone Production. Econ. Paper 12, 1931, 62 pp. 15 cents. The report considers the circumstances that affect the success of a crushed-stone plant, such as requisite qualities, preparation of stone for various uses, conditions and methods of quarry operation, production costs, market demands, transportation facilities, prices, and capital investment. Urges careful study of conditions surrounding proposed developments.

BOWLES, OLIVER, and JUSTICE, C. W. Growth and Development of the Nonmetallic Mineral Industries. Inf. Circ. 6687, 1933, 50 pp. A condensed 52-year history of the principal nonmetallic-mineral industries, with charts showing the relation of nonmetallic minerals to the building trades, highway construction, population, and industrial production. Contains a table showing the production value of stone. The accompanying text covers the development of the dimension- and crushed-stone industries.

FIELDNER, A. C., and EMERY, A. H. Research Activities in the Mineral Industries of the United States. Inf. Circ. 6637, 1932, pp. 152-154, 155-157, 176-178. A catalogue of research activities conducted by various agencies in the United States. Problems on crushed stone are listed under the section Sand, Gravel, and Crushed Stone; problems on building stone are listed under the heading Building Stone and Roofing Material; and safety and health problems of various stone industries are listed under the heading Safety, Health, and Miscellaneous.

HATMAKER, PAUL. Markets for Residential Stone. Inf. Circ. 6749, 1933, 14 pp. Outlines in a general way markets open to the stone producer or contractor in residential construction. The data are meant to suggest possibilities of developing further uses. Gives the general physical requirements of stone suitable for residential building, dimensions, data on depreciation and maintenance; describes construction methods; and surveys market areas.

HEALTH AND SAFETY REPORTS. Published annually in mimeographed form as soon after the close of the year as data are available. Contain advance statistical data of men employed, days of operation, man-hours of employment, and accidents at crushed-stone quarries for the calendar year.

_____. The Accident-Prevention Contest Among Crushed-Stone Quarries. Published annually in mimeographed form. Include data on the annual safety contest, with statistics of man-hours of employment and accidents at certain crushed-stone quarries for the calendar year.

_____. Employment and Accidents at Quarries and Related Plants. Separate reports of conditions in each State are issued annually upon completion of data. Include statistics of men employed, days of operation, man-hours of employment, and accidents at all quarries and related operations, by counties.

JOYCE, J. W. Electromagnetic Absorption by Rocks, with Some Experimental Observations Taken at the Mammoth Cave of Kentucky. Tech. Paper 497, 1931, 28 pp. 10 cents. Discusses the penetration of electromagnetic fields or waves into the ground and concludes that the fact that such waves actually penetrate rock has been established definitely. The results of this investigation show that a frequency of 500 cycles a second is well-suited for electromagnetic prospecting. Absorption, although present, does not materially limit the applicability of this method.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the dimension- and crushed-stone industries for the preceding year, published as soon after the close of the year as data are available. Contain final production figures, by uses.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Published each year from 1924 to 1931 as a separate and later as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Include detailed statistics and a résumé of conditions in the stone industries for the preceding year.

MINERALS YEARBOOK. Dimension Stone. Published each year from 1932-33 to 1935 as a chapter of the volume. Volumes, $1.25, $1.75, and $2, respectively. Present preliminary statistics and a résumé of conditions in the dimension-stone industries for the preceding year. Before 1932-33 Minerals Yearbook was published as Mineral Resources of the United States.

_____. Crushed and Broken Stone. Published each year from 1932-33 to 1935 as a chapter of the volume. Volumes, $1.25, $1.75, and $2, respectively. Present preliminary statistics and a résumé of conditions in the crushed- and broken-stone industry for the preceding year. Before 1932-33 Minerals Yearbook was published as Mineral Resources of the United States.

MINERALS YEARBOOK STATISTICAL APPENDIX. Stone. Published each year from 1932-33 to 1935 as a chapter of the volume and also as a separate. Separates, 5 cents; volumes, $1. Contain final statistics of the dimension- and crushed-stone industries for the preceding year.

QUARRY ACCIDENTS IN THE UNITED STATES. Published annually in bulletin form. Include statistics of men employed, days of operation, man-hours of employment, and accidents at various stone quarries in each producing State for the calendar year.

ROALFE, G. A. Quarrying and Crushing Methods and Costs at the Santa Catalina Island Quarry of Graham Bros., Inc., Santa Catalina Island, Calif. Inf. Circ. 6609, 1932, 15 pp. One of a series of papers describing operations, equipment, and costs at crushed-stone plants throughout the United States.

TYLER, P. M. Consumption and Prices of Nonmetallic Minerals. Inf. Circ. 6794, 1934, 50 pp. Summarizes consumption data for pre-war and post-war periods; discusses trend toward national self-sufficiency, prices, and the effects of the depression; and gives tables for the principal nonmetallic commodities, listing domestic production, net imports or exports, apparent consumption, and indexes of consumption and unit value. A table for dimension stone is included.

Technical-press publications:

ADAMS, W. W. Safety in the Quarry Industry. Crushed Stone Jour., no. 131, October-November, 1927, pp. 8-11.

_____. Safety in the Quarry Industry. Explosives Eng., vol. 5, November 1927, pp. 414-416.

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ADAMS, W. W. The National Safety Competition to Assist in Reduction of Mine and Quarry Accidents. Proc. Coal Min. Inst. Am., 1928, pp. 37-41.

_____. The National Safety Competition of 1928. Crushed Stone Jour., vol. 5, May 1929, p. 14.

_____. The National Safety Competition Results Show Tremendous Interest in Industrial Safety. Explosives Eng., vol. 7, June 1929, pp. 209-11, 238.

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_____. The National Safety Competition of 1932. Explosives Eng., vol. 11, June 1933, pp. 168-173.

_____. Accident Prevention Contest Among Crushed Stone Quarries in 1931. Crushed Stone Jour., vol. 8, September-October 1932, pp. 5-8.

_____. 1933 National Safety Competition. Explosives Eng., vol. 12, June 1934, pp. 160-165.

_____. 1934 National Safety Competition. Explosives Eng., vol. 13, July 1935, pp. 199-206, 219.

BOWLES, OLIVER. Steam Shovel Quarrying, Shooting Rock. Concrete, Mill ed., vol. 15, December 1919, suppl., p. 93.

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_____. Stones of the Department of Commerce Building. Stone, vol. 53, June 1932, pp. 283-284.

_____. The Stone Industries. McGraw-Hill Book Co., New York, 1934, 519 pp. A book that covers comprehensively the building-, decorative-, and crushed-stone industries in all their ramifications. It opens with a brief section covering general features of the stone industries and follows with a number of chapters on the individual varieties of stone for both the dimension- and crushed-stone industries. Each chapter gives a complete treatment of the stone under discussion, describing its distinguishing features, uses, the industry by States, distribution and occurrence throughout the United States, methods and equipment of quarrying and milling or manufacturing, cost data, handling for market, and other essential information.

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BOWLES, OLIVER. The Future of the Building-Stone Industries. Stone, vol. 55, November 1934, pp. 458-461.

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EVE, A. S., KEYS, D. A., and LEE, F. W. The Penetration of Rocks by Electromagnetic Waves of Audio and Radio Frequencies. Am. Inst. Radio Eng. Proc., vol. 17, 1929, p. 2072; Nature, vol. 124, Aug. 3, 1929, pp. 178-179.

GROSS, JOHN. Summary of Investigation on Work in Crushing. Trans. Am. Inst. Min. and Met. Eng., Milling Methods, vol. 113, 1935, pp. 116-129.

HATMAKER, PAUL. A Perspective of Rock Products Industries. Rock Products, vol. 35, Dec. 31, 1932, pp. 38-40.

_____. Keep Going with the Ordinary Stone and Lime Plant. Rock Products, vol. 36, Oct. 25, 1933, pp. 17-20.

ROALFE, G. A. Quarrying and Crushing Methods and Costs at the Catalina Island Quarry of Graham Bros., Inc., Catalina Island, Calif. Rock Products, vol. 35, July 1932, pp. 23-30.

THOENEN, J. R. Progress in Study of Quarry Costs. Rock Products, vol. 33, Jan. 4, 1930, pp. 135-136.

Trap Rock

Bureau publications:

CONWAY, J. A. Mining and Crushing Methods and Costs at the Monocacy Quarry of the John T. Dyer Quarry Co., Monocacy, Pa., Inf. Circ. 6405, 1931, 29 pp. One of a series of papers designed to disseminate technical information regarding the quarrying and preparation of nonmetallic minerals. The methods described in this paper are those of a trap-rock quarry. Plans of the quarry are illustrated by graphs, and a tabulated summary of operating costs is given.

HEALTH AND SAFETY REPORTS. Published annually in mimeographed form as soon after the close of the year as data are available. Contain advance statistics of men employed, days of operation, man-hours of employment, and accidents at trap-rock quarries for the calendar year.

MINERAL MARKET REPORTS. Advance statistical summaries of conditions in the stone industries, published annually as soon after the close of the year as figures are available. Include final-production figures of trap rock, by uses, for the preceding year.

MINERAL RESOURCES OF THE UNITED STATES - PART II, NONMETALS. Stone. Published each year from 1924 to 1931 as a separate and later as a chapter of the volume. Separates, 5 cents; volumes, $1-$1.50. Before 1924 these publications were issued by the United States Geological Survey. Contain detailed statistics and a résumé of conditions in the trap-rock industry for the preceding year.

MINERALS YEARBOOK. Dimension Stone. Published each year from 1932-33 to 1935 as a chapter of the volume. Volumes, $1.25, $1.75, and $2, respectively. Include preliminary statistics and a resumé of conditions in the trap-rock industry for the preceding year. Before 1932-33 Minerals Yearbook was published as Mineral Resources of the United States.

MINERALS YEARBOOK STATISTICAL APPENDIX. Stone. Published each year from 1932-33 to 1935 as a chapter of the volume and also as a separate. Separates, 5 cents; volumes, $1. Include final statistics of trap rock for the preceding year.

QUARRY ACCIDENTS IN THE UNITED STATES. Published annually in bulletin form. Includes statistics of men employed, days of operation, man-hours of employment, and accidents at trap-rock quarries in each producing State for the calendar year.

THOENEN, J. R. Study of Quarry Costs - Trap Rock, Sandstone, Granite. Inf. Circ. 6291, 1930, 24 pp. This report shows costs of various operations at trap-rock quarries, based on total tonnages sold in the calendar year 1927 as reported to the Bureau by operators.

Travertine

Bureau publications:

BOWLES, OLIVER, and BANKS, D. M. Onyx Marble and Travertine. Inf. Circ. 6751, 1933, 11 pp. Defines the terms "onyx" and "travertine" and discusses the origin, occurrence, and uses of each. Domestic and foreign deposits of commercial importance are described. The most important deposit of onyx is in Mexico and of travertine in Italy.